
SCIENCE EDUCATION

Formerly GENERAL SCIENCE QUARTERLY

SERVING TEACHERS IN ELEMENTARY SCHOOLS,
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AND PROFESSIONAL SCHOOLS FOR TEACHERS

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CONTENTS

NARST NUMBER INCLUDING ATLANTIC CITY PAPERS

George William Hunter	Honor A. Webb	131
The New President of NARST	Honor A. Webb	134
Ira C. Davis		136
Zachariah Subarsky		138, 142
Morris Meister		143
Edward K. Weaver		145
Oliver S. Loud		152
Warren P. Everote		158
George G. Mallinson		164
Philip G. Johnson		169
Glenn O. Blough		174
Earl R. Glenn		175
J. Darrel Barnard		185
W. C. Van Deventer		188
Katherine E. Hill		193
Betty Lockwood		198
NARST Program		205
Official Minutes		206
Report of Publications Committee		207
Treasurer's Report		208
NARST Constitution		209
Recently Elected NARST Members		210
Recent Deaths		211
UCES Officers		212
Paul E. Blackwood		212
Abstracts		213
Book Reviews		215

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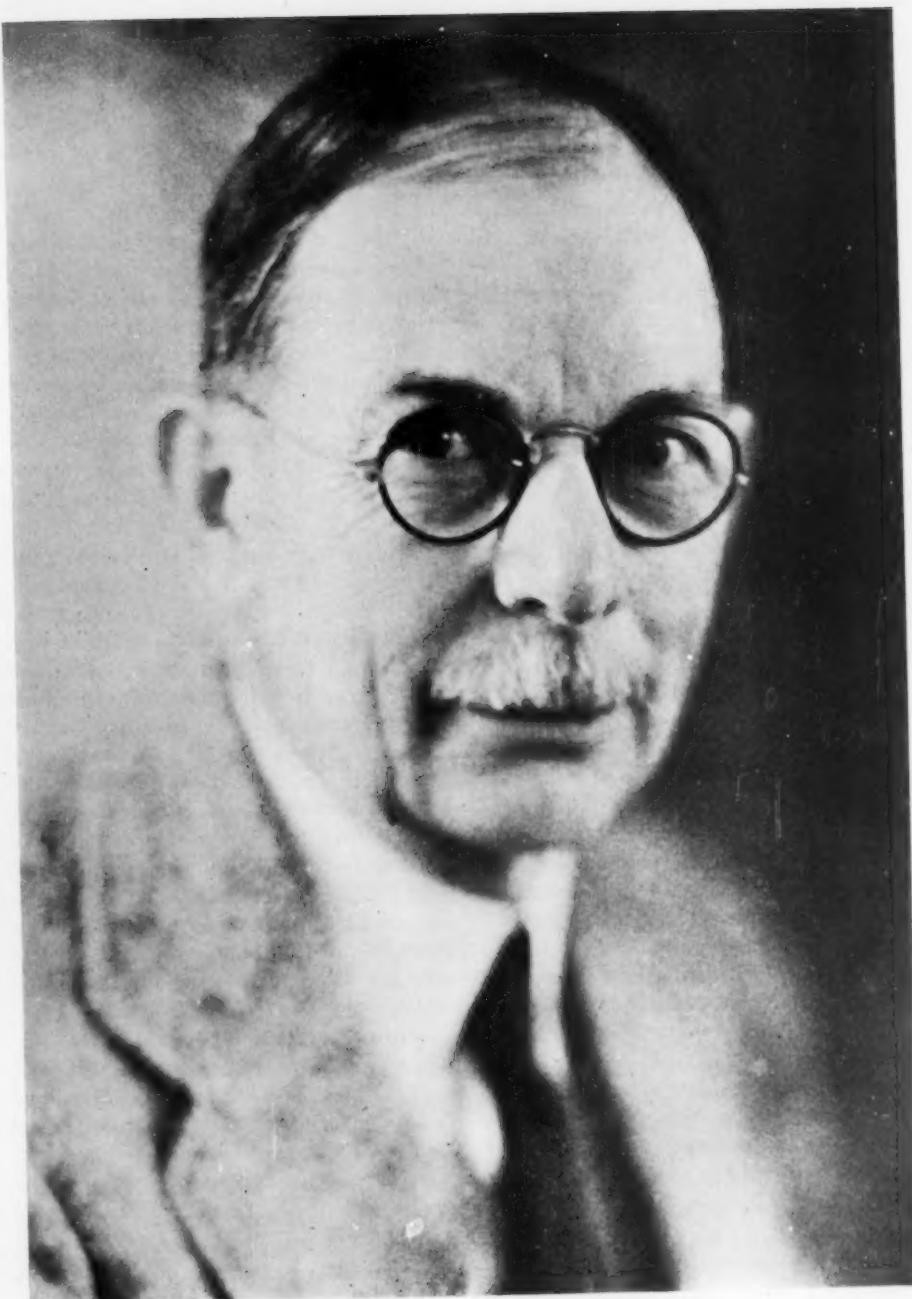
WE SEE	Pre-primer
SUNSHINE AND RAIN	Primer
THROUGH THE YEAR	1
WINTER COMES AND GOES	2
THE SEASONS PASS	3
THE HOW AND WHY CLUB	4
HOW AND WHY EXPERIMENTS	5
HOW AND WHY DISCOVERIES	6
HOW AND WHY EXPLORATIONS	7
HOW AND WHY CONCLUSIONS	8



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GEORGE WILLIAM HUNTER
(1873-1948)

GEORGE WILLIAM HUNTER (1873-1948)

DR. GEORGE W. HUNTER, veteran science teacher, author, and researcher, died in his home at Claremont, California, on February 4, 1948. The immediate cause of his death was a heart attack. His passing closes one of the longest active careers—more than half a century—on record in American science education.

George W. Hunter was born at Mamaroneck, New York, April 7, 1873. He married Emily Isobel Jobbins in June, 1899, who survives him after failing to reach the "Golden Wedding" by slightly more than a year. Three sons also survive: George W. Hunter III, Lieutenant-Colonel, U. S. Army, now in Tokyo; Cartwright Hunter, resident of San Gabriel, California; and F. R. Hunter, Associate Professor of Physiology, University of Oklahoma, Norman, Oklahoma.

George W. Hunter received his Bachelor's and Master's degrees from Williams College at the ages of 22 and 23. His first specialized teaching was as a fellow in zoology at the University of Chicago in 1896. He taught biology in the Hyde Park High School, Chicago, for two years, then in 1899 began a period of service in the DeWitt Clinton High School, New York City, that continued for twenty years. Post-graduate studies and lecturing in nature study and biology in New York University filled "spare hours" during these years, and the Doctor's degree was earned—via "the hard way"—in 1919. Four text books in biology were written during the same period.

A series of college positions followed—as Professor of Biology for one year in Carleton College, six years in Knox College, three years in Pomona College. In 1930 Dr. Hunter became Lecturer in Methods of Science in Claremont Colleges, Claremont, California. He was in the eighteenth year of this service at the time of his death.

Dr. Hunter wrote thirteen books bearing his own name as sole author, chiefly texts in the field of biology. He prepared thirteen books as co-author with Walter G. Whitman, chiefly texts in general science. Many revisions, manuals, and teaching aids are added to each list. Hunter's *Teaching of Science at the Junior and Senior High School Levels* (1934) is a distinct contribution to educational literature in respect to the techniques of teaching. With L. W. Kitch he prepared *Activities in Life Science* (1942). His most recent text is *Doorways to Science* by Hunter and Whitman (1947). In early 1948 he was collaborating with his sons (George W. and F. R. Hunter) on a text of college zoology.

Dr. Hunter's contributions to magazines are numerous. Most of them are reports of scholarly research in science education. These he carried out alone, or with graduate students. Subjects such as "Subject Matter of General Science," "Objectives of Science in the Secondary Schools of the United States," "Science Sequences and Enrollments in the Secondary Schools of the United States," are typical of the listings that appear in *Education Index* after publication in *SCIENCE EDUCATION*, *School Science and Mathematics*, and other periodicals. These articles included extensive bibliographies—almost a trademark of a magazine contribution by Dr. Hunter. At the time of his death a manuscript scheduled for *The Science Counselor* lay on his desk. No one can estimate how many additional studies, and published reports, were at various stages of organization in the mind and files of this most energetic scholar.

Dr. Hunter, however, was by no means tied to the data of his investigations. Over the years he developed a philosophy, which is revealed to some extent in his book on *The Teaching of Science*, but possibly more clearly in articles such as "Philosophy

for Teaching Science in a Changing World," published in *SCIENCE EDUCATION*, December, 1936. Quotations from this article show his freedom from the shackles of conservatism, and recognition of the principle that "nothing is changeless except continuous change." A selection of his significant phrases are these:

"To keep pace with these changes . . . our philosophy of science teaching must be pragmatic. We are not so much concerned with theories or even the 'big ideas' of science as we are in their practical applications in the lives of those we teach.

"The solving of problems has been man's lot ever since he first appeared on the earth. He has muddled along through unnumbered centuries and today, in spite of the changed world in which he lives, he still commonly ignores the scientist's methods of attacking such problems. It would therefore seem that one of the chief values of science in the modern curriculum would be the exposure of young people to the method of science. The beginner in science ought constantly to be habituated in the use of inductive and deductive methods in problem solving. The problems presented need not be difficult, technical, or abstract. On the contrary they should be concrete and related to the life experiences of the learner. But they should be used on every possible occasion so as to habituate the student in a way of looking at his life problems.

"Finally, my philosophy of teaching has always been Herbartian. Children have definite interests, just as do adults. . . . There is so much of interest in the world of science that our science classrooms ought to be filled with youngsters who work for the joy of working. . . ."

One of Dr. Hunter's most extensive studies was begun in 1940, and reported in *SCIENCE EDUCATION* for February, 1944, under the title "Six Hundred Teachers Look at Science Trends." The entire nation was covered by his questionnaire. The five questions he asked showed keen

appreciation, on his own part, of the trend. His summaries, concisely stated, are these:

1. Science courses are becoming more closely related to each other.

2. Science must be made more vital and functional if it is to retain its present place in the curriculum. Science is losing ground where the "new demands" are ignored, but holding its own or gaining where the social implications of science are recognized.

3. A majority of science teachers do not favor courses that are wholly "applied science," but recommend more attention to applications of basic science.

4. Science teachers are strongly in favor of individual laboratory work, if efficiently carried on. They recognize many values of good demonstrations as supplements, but not substitutes, for laboratory experience.

5. Increased attention is being given to the science adapted for students who will not enter college, but there is great diversity in the modifications of subject matter and presentations suggested.

One may wish that Dr. Hunter were now living to conduct a similar study on the influence of World War II on the trends in science teaching. Some competent, earnest scholar should follow in his footsteps in this matter.

Dr. Hunter's most noticeable characteristic was energy. His output of professional and text material could only have been achieved by extraordinary labor. At a meeting he was always in conference with one, or a few, fellow teachers, earnestly discussing some problem of mutual interest. He gave time and energy to professional organizations, as attested by his membership in The National Association for Research in Science Teaching, The National Science Teachers Association, The National Society for the Study of Education, The American Zoological Society, The California Association of Secondary Education. He was honored as a Fellow of the American Association for the Advancement of

Science, and as a member of Phi Delta Kappa and Theta Delta Chi.

The many miles that lie between California and the usual meeting places of science educators were no handicap to Dr. Hunter. He was one of the faithful whose attendance could be expected. This was

sincerely appreciated by his fellow teachers. Those who so often sat beside him on a hotel sofa or a bed, and joined in the stimulating conversations of which he was constantly the center, will not soon forget him.

HANOR A. WEBB

THE NEW PRESIDENT OF N.A.R.S.T.

DR. JOE YOUNG WEST, Professor of Science Education at the State Teachers College, Towson, Maryland, was elected President of the National Association for Research in Science Teaching at the annual business meeting in Atlantic City, February 22, 1948. His term is for one year.

Dr. West was born in Baird, Mississippi, on January 4, 1904, in a comfortable frame house. As a child he became steeped in the superstitions of the colored folk—one of the dominant factors of his environment. He finds their ideas still fascinating. He began teaching at the age of seventeen in an eight-grade, one-room rural school. Within a few years he had taught "all subjects in the 12-year curriculum except Latin and home economics," and had served as principal of an elementary school, and of a junior high school. Coaching, clubs, and community meetings were also part of his responsibilities.

West came to George Peabody College for Teachers, Nashville, Tennessee, planning to major in physical education. Science and the teaching of science fascinated him, however, and he majored in biology with a split-science minor for his Bachelor's and Master's degrees in 1931 and 1932. His chief counselors at Peabody were Drs. Jesse M. Shaver and Hanor A. Webb. Then for three and one-half years he was in charge of teacher-training in science for elementary schools at the State Teachers College, Radford, Virginia. He also served as consultant in

elementary science for the Virginia State Curriculum Revision program.

Beginning in 1935, West studied with Drs. Gerald S. Craig, S. Ralph Powers, and others at Teachers College, Columbia University. He received his Doctor's degree in 1937, for studies in the area of science in the elementary school ("A Technique for Appraising Certain Observable Behavior of Children in Science in Elementary Schools"). He joined the staff of the University of Maryland Summer School, and has taught for ten successive summers on this faculty. In September, 1937, he entered the Science Department of the State Teachers College, Towson, Maryland, and is in his eleventh year of service there. He is Chairman of the Science Department of this institution.

Dr. West carries out many unique teaching plans in his training courses, and survey courses in physical sciences. These involve much student activity and responsibility, rather than formal lectures. His students observe child development, study curriculum trends, evaluate children's science books, plan and conduct science fairs for various grades, gather and file material. All of this is in preparation for student teaching, which is carried out under the watchful eyes of Dr. West and his aides.

Dr. West has embarked upon a career of authorship, at present represented by co-authorship—with Wilbur L. Beauchamp and John C. Mayfield—of *Science Problems* (three volumes for junior high school



DR. JOE YOUNG WEST
State Teachers College, Towson, Md.

grades), and *Everyday Problems in Science*, a general science text for the ninth grade. He has critically read many manuscripts of elementary science readers and texts. Other books are projected, and will be completed by this energetic author in due time. Dr. West has also contributed articles to *SCIENCE EDUCATION*, *Junior High School Briefs*, *High School Highlights*, and other periodicals.

Dr. West's oldest hobbies have been piano playing and singing. To these he has recently added pottery and oil painting. To the amazement of all who discover his buoyant personality and graceful sociability, he is still a bachelor. "I manage to keep enough lady friends to make life interesting," is his only explanation.

Dr. West meets all of the criteria for worthy membership in the organization to

which he has been elected President. His teaching experience has been more diversified than that of most of us. He has planned little projects, and also big ones. He carries on as well as counsels. He writes both for simple minds and learned ones. He teaches by precept and by example. He is inordinately busy, but rides a hobby or two. Although possessing brawn a fighter would respect, he does not frighten children; his gentleness and poise are outstanding characteristics.

Dr. West did not covet the presidency of N.A.R.S.T.; in his modesty he believed others would be more efficient. But he has accepted the responsibility in all earnestness, and asks only counsel and cooperation from the members during his administration.

HANOR A. WEBB

SCIENCE IN FUNCTIONAL LIVING *

IRA C. DAVIS

University of Wisconsin, Madison, Wisconsin

WE hear many people say that we must get ready to live in the atomic age. These same people have the mistaken notion that every person can learn to live in this new age with a minimum of effort and understanding.

The development of the production of atomic energy is probably man's greatest discovery. Only a few of our best scientists understand the process. The manufacture of the atomic bomb carries with it so many social implications for evil that the scientists and military people are afraid to divulge its secrets. No doubt its utilitarian values are almost limitless but as long as its dangers and destructive powers are now known, the evil effects are paramount in people's thinking. How much better it would have been if the utilitarian values of atomic energy had been known first.

* Address of the President of the National Association for Research in Science Teaching at Annual Meeting, Atlantic City, New Jersey, February 22, 1948.

In what I have to say tonight, I am not primarily interested in atomic energy. For at least 99 per cent of our boys and girls it is something with which they will have but little experience in their school life. But I am interested in having pupils learn how to live in this scientific age of ours.

We have as science teachers devoted a large part of our thinking and research to objectives, goals, outcomes, evaluation, and philosophies. It is well that we have done so. But I am afraid that we have devoted too little thinking and research in educating pupils to live in a scientific age. I believe you will agree with me when I say that the only way pupils can learn to live in a scientific age is by having rich and varied experiences with the things science has created and with which pupils come in contact repeatedly. Surely we want pupils to acquire a large body of useful information but this information does not become knowledge and intelligence

without participation and experience in a large variety of activities.

I hope this association as well as all of the other associations interested in science education will direct their efforts toward providing all of our schools at all levels with a generous supply of materials, apparatus, visual aids, and rooms or laboratories where many kinds of activities may be provided. This is not a plea for more formal laboratory work as such, but rather useful and rich experiences with the great tools and inventions our scientists have provided. Pupils can be given exciting and valuable experiences with a mirror, lens, compass, wheel, air pump, lever, inclined plane, and magnet, just to mention a few great inventions. The emphasis is to be on learning how to use these inventions at home as well as at school.

I am not minimizing the need of providing experiences in the biological field. While many activities may be provided in this area in the classroom, the most valuable experiences may be provided by having pupils actively participate in simple soil erosion projects, conservation problems, camping activities, planting and maintaining gardens, bird clubs, field trips, the study and research of wild life, life cycles, functional health projects, and many others which may be mentioned. May I emphasize again that the great need in these activities is experience and active participation. The emphasis will be on what I like to call the what and how of science. Experiments, demonstrations, and activities give us the what and how of science but never the why. The "why" of science is obtained by reasoning and intelligence. But good reasoning must be preceded by the what and how. We are much too apt to have pupils who know the "why" of science before they are ready and prepare to reason or think. Furthermore it is doubtful if some of our pupils will ever become proficient in learning the why of science but many of them can learn the "what" and the "how."

Pupils may easily learn that seeds will germinate and grow into plants, probably one of the five greatest discoveries in science. They can also learn the best conditions for the germination of seeds and growth of plants as well as the conditions under which they will not do either. But do any of us know why they do it, or even much about the how.

Pupils may easily learn the properties of magnets, that compasses point north and south, and how magnets may be used to produce induced currents. But do any of us know why iron is magnetic or how a magnet produces a current when it is moved through a coil of wire. We have theories for explaining the why but do the theories really give us the answer.

As pupils progress from one school level to another, the number of units or topics will be expanded, activities will become increasingly difficult and varied, and the processes used in industry will be developed and applied. More stress will be placed on accuracy, and the methods of solving problems will become more scientific. The what and how of science will be broadened and enlarged, and the why will become increasingly important.

I am fully convinced that with good teachers and with a generous supply of materials and apparatus, the upper fifty per cent of our boys and girls can be doing the equivalent of two years of college science by the time they graduate from high school. If we are to keep up with progress we must expand our science program to keep up with our rapidly expanding body of knowledge and the increasingly large number of applications of scientific discoveries and inventions.

The greatest need for the development of such a program is good science teachers. We need teachers well grounded in fundamentals, and with rich and varied experiences in many fields of scientific knowledge. We need teachers who have learned how to live in a scientific age and who are

socially minded enough to know what science can, and cannot, do to improve our ways of life.

When the program I have suggested has been developed and taught for several

years by well educated science teachers then, perhaps, we may be in a position to have a fair degree of understanding of the applications and social implications of atomic energy.

HUMAN RELATIONS IN OUR TIME—A CHALLENGE TO THE EDUCATOR

ZACHARIAH SUBARSKY

High School of Science, Bronx, New York

As modern developments in transportation and communication continue to shrink the world, as industrial evolution continues to integrate through interdependence ever vaster areas of the earth, inter-cultural and inter-racial relations, heretofore community problems, have become national and even world problems.

At the present writing, for example, the Zionist Jews are at loggerheads with Palestinian and other Arabs. The Moslems of Pakistan and the Hindus of India are at each other's throats. A menacing abyss yawns between the people of the United States and the people of the Soviet Union as these two peoples move farther and farther apart in their ideologies.

Within our own country, the seemingly endless collection of gruesome details of group conflict as reported, for example, in *Race Relations*¹ or in the *Bulletin of the Anti-Defamation League*² range from personal indignities to violent bloodshed. Part II of the report of President Truman's Committee on Civil Rights points up the discrepancies between our civil rights principles and our practices. These discrepancies are increasingly becoming the concern of enlightened Americans. Irrational racial and religious prejudice is sand in the machinery of our social, economic, and political institutions. Such prejudice

invades our homes, our factories, our legislative halls, and even our universities.

It seems plausible that in international relations these tensions can be attributed, in part, to a short-range quest for security, which involves competition for military bases, access to or control of raw materials, foreign markets, and the like. In individual and community relations too, tension and conflict are frequently motivated by economic factors—the competition for jobs, for limited housing facilities, or for political advantage. However, these international or community tensions are often nurtured on misconceptions about fellow human beings—misconceptions that are transmitted culturally from one generation to the next. If the true causes of human conflict are to be exposed to light and dealt with rationally, mankind must first be freed from these misconceptions and superstitions. That this task constitutes a formidable challenge to our public schools has been amply demonstrated by Mr. Frank E. Karelson, Jr., who collected the reactions of outstanding leaders in American education on the problems of human relations.³ It is significant that "Ten of the respondents mention specifically that the pupils in the schools should be given the actual scientific facts about race and culture. This would include a range from Biology through the more factual aspects of Anthropology and Sociology."

¹ *Race Relations: A Monthly Summary of Events and Trends*. Published by the Social Science Institute, Fisk University, Nashville, Tenn.

² *Bulletin of the Antidefamation League of Bnai Brith*, 10 N. LaSalle St., Chicago, Ill.

³ Karelson, Frank E., Jr. *Human Relations—A Challenge to Our Schools*. New York, 1947.

Speaking before the final session of the 1948 United States Conference of Mayors, Dr. James B. Conant said:

"If we are to be strong in this tough post-war world, we must strengthen our faith in these (democratic) ideals and make our social realities a closer approximation to these ideals. Seen in such a setting, the problems of our public schools take on an exciting nature; they are recognized as second to none in importance from the point of view of the survival of our free society."

The experimental work described below is based on the assumption that many of the misconceptions that nurture racial and religious conflict can be obliterated by developing in people the following understandings:

1. Culturally, a human being is the product of his total life-long environment.
2. The potentialities for acculturation of any human being are independent of hereditary physical characteristics.
3. There is no scientific validity to an ordinal classification of present day human races—from primitive to advanced—in the scale of evolution.
4. Present day national groups are genetically heterogeneous populations.
5. Our present so-called "Western Civilization" is the product of many races, national groups, and cultural groups.
6. A degree of cultural and religious heterogeneity is compatible with a progressive democratic state.
7. Racial discrimination retards cultural progress.

The second assumption on which this experimental work is predicated is that, in the present setup of secondary schools, the biology teacher and the social studies teacher are in a strategic position to develop these understandings, and that they can develop these understandings most efficiently if they pool their efforts.

The essential biological concepts needed for understandings referred to above are now being developed in good courses in Tenth-Year Biology. However, the full social implications of these concepts are frequently overlooked due to shortage of time, to limited social-studies training on the part of biology teachers or to both. On the other hand, the essential social studies concepts are now being developed

by the better teachers of social studies. However, these concepts are frequently taught as dogma. Our experience indicates that when these areas of biology and the social studies are brought together, we get something that is indeed greater than the sum of the parts; that socio-biological concepts emerge with which the student readily identifies himself and about which he tends to have the conviction which we have come to associate with science learning.

Practical minded school administrators will be quick to notice that what is here proposed does not involve adding courses to an already crowded curriculum. It is proposed, rather that we "bring together the things in the curriculum that belong together" utilizing the professional competence of existing specialized teachers to focus on an educational objective of the greatest social importance.

EXPERIMENT

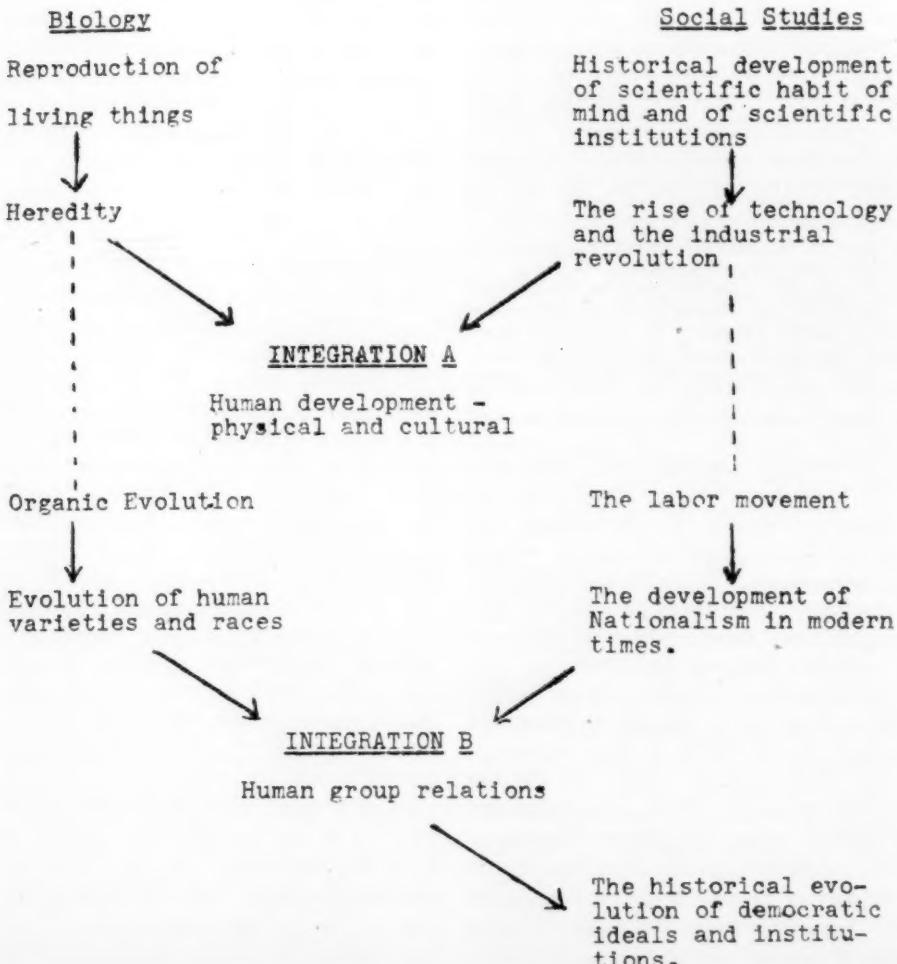
In September, 1944, after about a year of preliminary planning, a tenth year class was chosen at the High School of Science in New York City and designated as an "experimental class." For this group of thirty-eight boys (at that time the High School of Science was an all-boys school) the biology and social studies periods were made contiguous. The "free" periods of the two teachers were so programmed as to enable the teachers, i.e., the biology teacher and the social studies teacher, to visit each other's classes to get acquainted with the content and angle of each other's subjects. In addition, the two teachers conferred at frequent intervals to consider and to strengthen the integration between their two subjects in line with the objectives of the project.

In February, 1945, two such classes were set up under arrangements similar to those described above. By the end of that term we felt that an evaluation of the set-up was necessary. More specifically, it was important to determine whether desirable

changes in pupil-attitudes under the new arrangements were significantly greater than under the conventional arrangements where students take the "normal" courses in biology and social studies under conventional conditions. Consequently, in September, 1946, two experimental classes were set up at the High School of Science. Five classes at the same school were designated as control groups. These were given the conventional courses of study in biology and social studies and were taught by other teachers in the school. To take into

account the school factor, the cooperation of the Principal of another school (Stuyvesant High School) in New York City was obtained. This school selects science-minded boys by the same set of entrance examinations as does the High School of Science. Five classes at Stuyvesant High School giving the conventional courses in biology and social studies, were designated as constituting another set of control groups. In neither the experimental nor the control groups were *individual* pupils in any way selected. All classes had been

SCHEME SHOWING THE GENERAL SET-UP OF THE EXPERIMENTAL INTEGRATED BIOLOGY—SOCIAL STUDIES COURSES OF STUDY, SHOWING UNITS AND FOCI OF INTEGRATION



routinely established by the program committees of the respective schools. The experimental classes were given the modified integrated courses in Biology and Social Studies. (The details of the modifications will be reported elsewhere.) All groups were tested at the beginning of the term and again at the end of the term. All groups took the same New York State Regents examination in Biology at the end of the term. All groups had taken the same conventional courses in Biology and in Social Studies the previous term.

In February, 1947, administrative difficulties compelled Stuyvesant High School to withdraw from the experiment. However two more experimental classes and five control classes were set up at the High School of Science under the same arrangements as the previous term.

EVALUATION

Experimental and control groups were subjected, before and after instruction, to a battery of three tests as follows:

1. *Attitudes and Application of Principles.* To determine the extent to which biologically and historically valid concepts have been assimilated. This test was prepared by the writer.

2. Opinion Survey—S. To determine the degree to which a pupil thinks about people in terms of stereotypes. This test was prepared by the *Commission of Inter-community Interrelations*.

3. Opinion Survey—Form A and Form B. To measure attitudes toward discriminatory practices. This test, too, was prepared by the C.C.I.

Other data pertinent to the problem were also obtained, both for the experimental and for the control groups. These included data on age, socio-economic status, intelligence quotients, ratings on school entrance examinations, and marks in the New York State Regents examinations in Biology. Analysis of the data was based upon statistical tests of the significance of the differences between means of control and experimental groups.

FINDINGS

1. *Test for the assimilation of valid concepts.* In the September, 1946, experiment, the experimental group showed a significant gain over the control group. In the February, 1947, experiment, there were gains in both groups but the superiority of the Experimental gain over the Control gain was small. The smallness of the gain difference may have been due to the fact that the same teacher who had had precious experience with the integrated biology-social studies program during the previous Fall term, taught both experimental and control groups during the Spring term.

2. *Test for "stereotype" thinking.* There was a steady decrease in the scores of all groups. Evidently some school or environmental factor was operating to produce this effect.

3. *Test for change in attitude toward discriminatory practices.* (It should be pointed out that of all types of pencil-and-paper tests, this type of test is believed to be most closely correlated with actual behavior.)

Initially, the experimental group was more prejudiced than the control group. There was no significant change in attitude in the control group. There was a significant positive change in the experimental group.

CONCLUSIONS

No wide generalizations are warranted, for the following reasons: (1) The subjects of these experiments were mentally superior children from middle class homes. (2) There were few negroes. (3) The classes were highly saturated with Jewish children. (4) There was comparatively little initial prejudice. It remains to be determined whether changes in attitudes can be effected by similar means in groups of average or less-than-average mental ability, where the groups are racially and culturally more heterogeneous, and where there is a high degree of initial prejudice.

This much, however, can be concluded: that, given a group of tenth-year high

school pupils of high intelligence, and given a set of competent and enthusiastic biology and social studies teachers, the integration of the two subjects along lines indicated above, can bring about greater changes in attitudes than are produced by our conventional courses in these subjects.

Further experimentation is necessary, and would indeed be desirable, to determine the degree to which the teacher-factor, the nature-of-the-pupil factor, and the organization-of-the-learning factor were responsible for the changes in attitudes here reported.

TWO SCHOOL-MADE MOTION PICTURE FILMS FOR LABORATORY TEACHING OF BIOLOGY *

ZACHARIAH SUBARSKY

The High School of Science, Bronx, New York

II. HOW TISSUE SLIDES ARE MADE

"PREPARED" microscope slides are used even in the most elementary courses in biology. But there are few students even in college courses in general biology who have an adequate understanding of the relationship between the "prepared" slide they see under the microscope and the tissue or organism from which the material on it came. Moreover, such students have but little appreciation of what goes into the making of a "prepared" slide. Hence, they have a limited basis for interpreting what they see. Because it is so time-consuming, an adequate demonstration of how slides are made is out of the question in any but histology classes.

This film has been produced to meet the above needs. Incidentally, we have found it useful in providing information for the student who becomes interested in making his own slides. Indeed, it is conceivable that the film may actually engender such an interest.

II. DISSECTION OF THE FROG

We inform our students that there is a difference between dissection and butchery. Unless they are given preliminary instruc-

tion students, at best, resort to butchery. Such preliminary instruction traditionally is given in one or more of the following forms:

1. Oral description of what is to be done.
2. Printed or mimeographed description of what is to be done.
3. Demonstration by the teacher of what is to be done.

We have found oral instruction to be inadequate. Also, we have found that the more mimeographed instructions are elaborated, the more difficult and time-consuming they become for students. On the other hand, demonstrations are ideal; but only for small groups of students. For larger groups—say, thirty-five to forty—we find demonstrations difficult for the following reasons:

1. It is difficult to get every student close enough to the dissection being demonstrated.
2. Even if the above were feasible, students do not retain all the steps in the dissection.
3. When an attempt is made to demonstrate one step at a time, it is extremely inconvenient and time-consuming to gather the class around the demonstration table as many as fifteen times during a laboratory period.

This film obviates these difficulties in that every student practically has his nose in the demonstration while he remains at his own table.

It has been judged successful by several of our teachers who have used it with many classes over a period of several semesters.

* The two films discussed in this article, *How Tissue Slides Are Made* and *Dissection of the Frog*, were produced in the Bronx High School of Science and were shown to members of N.A.R.S.T. at the Atlantic City meeting.

SCIENCE ROOMS FOR SECONDARY SCHOOLS *

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POINT OF VIEW

THE products of scientific research during the past few decades have altered our ways of living. Those changes include not only a host of technological applications, about which every citizen must be intelligent, but also a method of solving problems and a scientific outlook. The secondary school must achieve a two-fold objective through its program of science studies. First, it must contribute to the general education of all pupils. Secondly, it must locate and further the development of science talented youth. Unless it achieves the latter purpose, an important national human resource will be wasted. Unless it achieves the former objective, the people will not support the plans, efforts and recommendations of our scientists and technologists. Neither objective can be adequately attained in the secondary schools without properly designed and equipped science rooms.

The generally accepted program of science teaching in secondary schools is conducted in a group of specialized rooms provided with special facilities and equipment. The learning outcomes and teaching procedures in science are uniquely dependent upon the availability of these facilities. Teachers, laboratory assistants and pupils devote a large portion of their time and energy in procuring, devising, organizing, caring for, repairing and manipulating a vast array of teaching materials. To a large extent, existing practices in science teaching, in so far as they include the use of this specialized equipment, are the result of analysis, research and testing.

TEN GUIDING PRINCIPLES

1. *In general, a science room is a place where the pupil may receive educative experiences which give better understandings*

* A "Standard" proposed by Morris Meister for consideration and adoption by N.S.T.A.

of those generalizations in science that contribute to the enrichment of life.

The emphasis here is on the word *experiences*. As here defined, the science room is a means to an end rather than an end in itself. It is not intended that the pupil in such a room shall imitate the research workers, except in the sense that he, too, is gathering evidence on the basis of which he will arrive at conclusions. The room must make it possible for the teacher to so "set the stage" that questions can be put to nature and answers be derived through observation and reason on the part of pupils.

2. *The experiences for which science rooms shall provide are justified by, and take their origin from, the prescribed program of science studies.*

Practice based on this principle will avoid teaching which is organized around facilities that chance to be available. While the program of science studies tends to change more rapidly than buildings and equipment, it is possible to plan rooms and facilities in such a way as to make adaptations and change reasonably possible. The recommended group of science rooms presupposes the following sequence of science studies in the secondary school:

Ninth grade—	General Science
Tenth grade—	Biology or Applied Chemistry or Applied Physics
Eleventh grade—	Physics or Chemistry or Earth Science
Twelfth grade—	Physics or Chemistry or Earth Science or Special Science

3. *A science room or facility must be evaluated in terms of the educative experiences which it makes possible.*

It is probably true that no necessary correlation exists between the cost of a facility

and its educative value. Yet it is often also true that teachers of ability and experience must devote a major portion of their energies to overcoming handicaps due to the lack of proper facilities. A costly item of equipment is justified if its contribution is great over a long period of time, and if it releases the teacher's energies in the right directions.

4. A science room must be a place where the experience in problem-solving is possible.

The effect of this principle is not so much a matter of radical change in design and equipment as it is in attitude toward the use and organization of facilities. The latter must provide for individual differences and special abilities. It must make possible the exploration of pupil interests and capacities. It must provide factors of enrichment. It must be noted that problem solving requires some degree of skill in manipulating science materials, and instruments of measurement. In short, this principle justifies the various laboratories in which pupils can themselves carry on experiments adapted to their level of maturity and understanding.

5. The design of both science classrooms and laboratories should provide facilities for effective teacher and pupil demonstration.

The work of many investigators has called attention to the value of demonstration teaching. Demonstrations are essential to many types of learning in science. Many laboratory exercises can be more effectively presented as teacher or pupil demonstrations. In planning science rooms, therefore, considerable attention must be given to this activity. The size, position and equipment of the demonstration table are matters of importance. Visibility, illumination, accessories, proper display, convenience, time-saving and labor-saving devices, and the avoidance of waste motion are all factors to be considered.

6. Certain science rooms should provide facilities for individual laboratory work.

Manipulative skills, resourcefulness, and facility in problem solving can come best from a teaching procedure which enables pupils to experience individually. At least three types of activities must be possible in a laboratory.

a. Exercises required of all pupils and requiring multiple sets of equipment which develop better understanding and skill in manipulation.

b. Laboratory exercises from which students may select in accordance with special needs and interests.

c. Exercises originating in problems formulated by pupil or teacher. These problems may be original or may be modeled after some basic research or discovery.

7. Science rooms should provide certain facilities for objectification by means other than use of concrete materials.

This guiding principle calls attention to such items as the blackboard, bulletin board, display fixtures, charts, and especially the rapidly developing class of facilities referred to as audio-visual instruction. Often these facilities can provide experiences as real to the pupil as are many of the demonstrations and the laboratory exercises. They may surpass the latter in variety, clarity, and pertinency. Occasionally they may supplant a demonstration or laboratory experience involving hazards or exorbitant cost of a complicated skill not to be expected at the secondary school level. Hence science rooms must include facilities for the operation of such devices as the motion picture, radio, sound recording and production, and television.

8. The planning of science rooms and their equipment should be a cooperative project in which the architect, the engineer, the educational supervisor and the science teacher each play a proper part.

The experience and knowledge of each of these individuals must not be ignored. Great saving in cost and increased efficiency in use can result from cooperative planning. Among the important questions that

such planning must answer for each school in advance of construction are:

- a. How large shall the science rooms be?
- b. How many pupils shall they accommodate?
- c. How shall the science rooms be grouped?
- d. On what floor shall science rooms be located?
- e. How shall preparation rooms and storage rooms serve the needs of science classrooms and laboratories?

9. *In schools designed for 1,500 or more pupils, the numbers enrolled in science courses and the number of science teachers involved are such as to require facilities that can best be administered by laboratory assistants.*

Since the teaching load of science teachers is usually the same as for teachers of other subjects, science teachers must have the service of laboratory assistants. This, in turn, presupposes the availability of preparation rooms where materials can be effec-

tively organized for use by 8 to 10 science teachers, both for demonstrations and for individualized laboratory work. Adequate preparation rooms and storage facilities will pay for themselves in the long run through lower maintenance and replacement cost. Without such facilities, large schools are compelled to reduce drastically, or even to eliminate, demonstrations and laboratory experiences for pupils:

10. *Adequate provision for science talented youth demands the special facilities referred to as biology and physical science project rooms.*

While the elementary laboratory rooms and science recitation rooms will meet the needs in general education, the science project rooms provide an outlet for the interests of those gifted in science. The latter rooms must be so designed as to make creative work possible. They also provide facilities for the science teacher to continue his professional development. They are also the basis for an in-service training program for science teachers.

MEETING THE NEEDS OF NEGRO TEACHERS

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ONE trend in education is to bring the school and community closer together into such intimate relationship that the social, human, and natural resources of the community may be used better to solve the problems of all the people, serve their interests, and satisfy their needs. But efforts of Negro teachers, in the segregated schools, to fuse the Negro people into the life of the community involves them in basic and fundamental conflict with the prevailing cultural pattern. The very nature of the bi-racial and segregated pattern within the South isolates institutions which train Negroes for teaching, and demands that teachers of Negro youth develop special skills, attitudes, useful techniques of community integration, and that these teachers

gain special competency to deal with socially significant and highly controversial issues which are a part of everyday living as a Negro in the American democracy. Those socially significant and controversial issues lie in areas to which science has a great deal to contribute.

A study was made to ascertain the extent of teacher knowledge about the communities in which they teach; to ascertain teacher opinion about some socially significant and controversial issues which lie in areas of science education; and to ascertain the significance of these findings for clarification of the educational needs of Negro teachers. Questions were asked to ascertain teacher knowledge about the community's physical, social, and natural

resources; its industries, businesses, communicative and transportative facilities; its local government and provisions for social welfare, housing, recreation, and library facilities; the educational level of the people; the children who are taught and the homes from which they come; provisions for frequent and direct contact with the facts, ideas, social practices, traditions, and institutions which are a part of the community. A second phase of the investigation involved the opinions of teachers as to their responsibility in dealing with unsolved socially significant and controversial issues to whose solution science has a contribution to make.¹

The data of this study indicate that the majority of teachers who work in schools for Negro youth are graduates of a Negro college. Too large a number of these teachers are teaching in areas of subject matter specialization for which they were not prepared in college. This is especially true of science majors who are teaching, in a majority of instances, in areas of subject matter without either a major or, often, a minor in science. Too many of these science teachers report a concentration in chemistry, but are teaching biology and physics. The evidence supports the conclusion that there has not been enough guidance of teachers into the elementary field of specialization, and a disproportionate preparation for chemistry research, when the teaching needs lie in biology and physics. Colleges have not shouldered their responsibility to prepare teachers for the schools in which they will work.

In each section dealing with specific aspects of the community, respondents indicate that college courses were of least value in providing them with knowledge about the community. Regardless of how the data are considered, these teachers cannot be said to have adequate preparation for participation in an educational program based on a school-community approach to

the problems of community living. An important educational need is provision of adequate opportunity to secure competency necessary to work in an educational situation demanding school-community integration of the materials of the educative process.

Further, teachers used conversations to a rather high degree to secure knowledge of the community which they did possess. This indicates the need to provide prospective and in-service teachers with adequate tools for collecting information about the community. The need is to develop within students competency in interview and other conversational techniques, and techniques and skills of conducting community surveys in realistic and meaningful situations while in college.

The urgency of the Negro people progressively to solve their problems of full integration into American life forms the base for the most serious consideration and concern for utilization of all the human, social, and natural resources of the community in solving personal-social problems. Without techniques for integrating the Negro people into the community, the school-community program becomes sterile and ineffectual, for the school thereby has failed to concern itself with the everyday life problems of its clientele.

The task is to prepare teachers who will work in such manner that they are intimately connected with the life of the community, and the school will serve as a center for many community activities using community resources to improve the community situation. At present, college courses are of least value in providing teachers either with knowledge of the community, or techniques to secure this knowledge. At present teachers do not know enough about the communities in which they teach to serve persons of school age, and certainly not persons of all ages and groups, either in the evening or during the day, through the school's workshop, library, gymnasium, assembly hall, or other facilities of the school.

¹ Edward K. Weaver. *Meeting the Needs of Negro Teachers*. Unpublished doctoral project, Teachers College, Columbia University, New York, 1947.

There exists a direct relationship between the historical, social, political, economic, and cultural milieu. The isolation of the Negro people in American life results in an educational pattern designed to prevent the Negro people from creating the social changes which are necessary to progressively eliminate the now generally unsatisfactory conditions of Negro life in America. There is an important relation between the failure of colleges preparing Negroes for teaching to provide Negro teachers with the competency to deal with the problems which most affect the Negro people. The success of the cultural and economic pattern in preventing the Negro people from securing competency to fully integrate themselves into community life is a function of the Negro college which, as the formalized and institutionalized representative of the prevailing cultural pattern, is designed to increase the isolation of the Negro people from the culture. The prevailing cultural pattern, then perpetuates, through pseudo-scientific postulations, white supremacy and racist dogma, segregation and discrimination, and isolation of the Negro people. The result is that, through the segregated Negro college, Negro teachers are provided an inadequate preparation and insufficient technique to deal with those very school-community problems whose solution would abolish patterns of discrimination and segregation.

The cultural pattern of the United States, especially in the South, is inconsistent and contradictory. It is based on the American slogan of justice, equality, liberty and inalienable rights for all, but at the same time forces onto the Negro people assumption of inferior roles, and realization of democratic relations on planes of low reality. The segregated Negro college preparing Negroes for teaching must work within this inconsistent pattern. What do these colleges adopt as the pattern of belief and conduct in socially significant and controversial areas on which there is scientific evidence?

Education and science are two areas

wherein there exists a considerable respect and acceptance among the people. They are likewise the two most clearly adapted and accepted instruments for realization of the democratic aspirations of the Negro people. But these two areas have been the very instruments which have been used most ineffectively. Our society desires, perhaps, needs, this result.

Teachers were asked their opinions about the immutability of human nature. Questions included opinions on whether man has inborn tendencies or predispositions for certain cultural forms, social and economic arrangements, religious experiences, predispositions towards communism, fascism, or democracy, polygamy or monogamy, or acquisition and accumulation of private property. The teachers' opinions indicate that they implicitly assume that the traits common to American culture today are the correct and "natural" ones. The teachers refused to take a stand on whether either inheritance or culture is the largest determining factor.

College teachers, high school teachers, and graduating college seniors revealed confused and contradictory opinions on the immutability of human nature, opinions which were not based on any apparent reliance upon the findings of science and cultural anthropology. The respondents were confused about institutions and ways of life which exist or have existed and are, as a consequence, incompetent to teach for democracy. Further, the fact that most Negroes have never had opportunity to experience democracy adds to the inconsistency and contradiction of the respondents in regards to democracy as a workable philosophy and way of life. There is real educational need to provide these teachers with available scientific evidences on present and past ways of life and institutions. The evidence supports the conclusion that the economic and cultural isolation of the Negro people, patterns of segregation and discrimination, inferior educational facilities for Negroes, combine to cause Negro youth to leave schools with incon-

sistent and contradictory opinions about the most important aspects of American democratic life. There is reason to question the benefits of four years of college preparation which results in such confusion, both on the part of teachers as well as students.

However, cultural as well as economic factors do not provide adequate bases for continued failure of Negro colleges and teachers to provide adequate opportunities for students to have experiences calculated to develop within them consistent and scientific points of view. It cannot be assumed that concepts of racial inferiority, or patterns of segregation and discrimination will disappear spontaneously. Neither slavery nor fascism were justified on scientific bases, but they operated nevertheless. What is needed is the highest levels of competency in the Negro school, a conscious and deliberate approach to the problems of American democracy, a plan and approach to the solution of the Negro problem through utilization of the method and materials of science, and provision of techniques for application of knowledge in bringing about necessary social change and reconstruction. The need is for a more realistic approach to the solution of the problems of the Negro people by Negro teachers in Negro schools.

Teachers were asked their opinions about significant differences in inborn psychological traits and abilities of children from various socio-economic groups, or whether differences result from environmental variations. The majority of the teachers believe that differences in ability result from the impact of both the environment and heredity. However, respondents believe that the biggest factor producing these differences is biological inheritance. Recent concepts, however, supported by scientific evidences tend to support the opposite conclusion. College teachers, high school teachers, graduating college seniors accept the status quo as an indication of the individual's innate traits and abilities. Thus the respondents felt that education would not

help individuals to rise to higher socio-economic levels, and imputed the reason for this to inborn psychological traits and abilities rather than the economic system—the assumption was that inferior individuals are in the low socio-economic levels.

The implications of this point of view lie in the fact that the majority of the Negro people have low socio-economic standing, hence, the assumption actually means that the Negro teachers responding in this study assume that Negroes (the majority) are innately inferior and their low socio-economic status results from inferior biological inheritance.

Teachers were asked to give opinions on significant differences in psychological traits and abilities of individuals of various races, and to express opinions as to whether differences which appear result from cultural differences and cultural pressures. A high percentage believe that environmental factors, including cultural pressures, are responsible for the largest amount of differences which exist between ethnic, religious and other groups. But the respondents felt that white Americans and Mexicans possess more native inferiority than other groups mentioned in the study. This is in contrast to other studies which indicate that respondents believe in the native inferiority of Negroes. It is important in that it indicates that the prejudices of the group expressing opinions becomes a factor of response to the prevailing cultural pressures. Hence, either group projects onto the other group the cultural pattern of allegation of native inferiority. The prejudice exists in opposite directions. Negro teachers, then, have prejudice against white Americans and Mexicans, but also are confused and contradictory in such prejudice as revealed in their response patterns. The cultural position and isolation of the Negro people in the American democracy is of such nature as to force the Negro people to develop such distorted and tilted reactions since the prevailing cultural pattern is also distorted and tilted in terms of racial myths of white supremacy. The

need, then, is to deliberately and consciously, and in a planned sequence of educational experiences, explore and explode the fallacies of racist dogma both as applied to the Negro people, Mexicans, whites, and other groups in the society.

Teachers expressed opinions as to whether science teachers should deal only with the empirically determined body of scientific facts, or go beyond the facts into socially significant controversial areas into the realm of opinion and value judgment. College teachers, college graduating seniors, and high school teachers contradict themselves in each specific question in this area. As an example, college seniors believe that science teachers should only engage in those areas in which conclusive factual material is available, but they also believe that it is important and necessary that science education actually deal with present unsolved problems and offer science's best evidence on these problems. The college courses did not deal with such controversial and socially significant issues, since teachers did not indicate that even soil erosion, an ever-present problem still in the South, had been dealt with in their professional preparation. Hence, the conclusion seems justified that neither the college teachers, college graduating seniors, or high school teachers had the necessary backgrounds of scientific knowledge to form opinions and value judgments.

Of sixteen controversial but socially significant issues on which teachers expressed opinions neither the college teachers as a group, college graduating seniors as a group, nor the high school teachers as a group made identical selections. Subject matter specializations did not make apparent differences in the avoidance of these areas. The majority of respondents agree that socially significant controversial issues are of importance in science education, but they also indicate that they would avoid most of them in their teaching. Reasons given are insufficient personal knowledge, lack of pupil maturity, fear of disapproval of parents, and fear of pressure from out-

side groups. Issues avoided include man's place in evolution, political questions involving conservation of natural resources, socialized medicine, consumer education, sex education, moral codes and ethics, relative merits of the healing arts, conflicts in view of the universe and man's place therein, and conflicts between traditional beliefs and science. The college graduating seniors were most concerned with these questions. Teachers avoid those issues which they believed to be most important in solving the problems of youth. For to deal with these problems means a change in the method and content of instructional programs, and provision of specializations so that teachers may teach scientific aspects of problems which young people and adult must, and will, deal. But the colleges preparing teachers still operate on subject matter specialization areas of biology, chemistry, physics, and other courses, hence teachers are not competent to deal with problem areas, and, consequently, avoid these areas in their teaching.

Teacher opinion on evolution, man's place in evolution, and whether evolution should be taught in the schools is equally confused and contradictory. Responses become an index to the inability of teachers to deal effectively even in areas wherein there is a considerable body of scientific evidence. Evolutionary doctrines and theories have accumulated a vast body of scientific materials, yet these teachers cannot be said to express scientific attitudes toward evolution. The same is true of opinions about control of scientific research. While there is, in our society, a general trend to accept the social function and role of science and a growing belief that scientists must take leadership in seeing that scientific inventions and discoveries are put to social use for benefit of all the people, such increasing concern for the social function of science is not reflected in the opinions of these Negro teachers. The conclusion seems justified that the opinions of these teachers reflect their inadequate college preparation and isolation from the

mainstream of important everyday decision in the American society.

Teacher opinions on determinism, supernatural intervention into the affairs of men, and interpretations of the relation of science and traditional religious beliefs indicate the existence of a great deal of misconception, misinformation, superstition, anachronism, and pseudo-science among Negro science teachers. Teacher opinion included the opinion that it is wicked to inquire into religion and determinism, and yielded instances where more than 50 per cent of the high school teachers felt that sincere prayers for rain are helpful, that natural explanations cannot account for cases of dreams come true, that systems of astrology, numerology, and other such methods can offer indication of future events.

To the extent that the respondents in these studies represent Negro teachers, and their opinions are their true opinions, the following summarization may be made:

1. The majority of Negro teachers are graduates of Negro colleges.

2. These teachers have a wide varied background of information and knowledge about the communities in which they teach. Information and knowledge about communities is secured, essentially, through conversations and reading after the teachers leave college. The teachers claim, without exception, that college courses are of least value to them in enabling them to know the communities in which they teach.

3. A large majority of teachers conceive as their function, the task of facing, with young people, the problems, needs, and interests of society, and in bringing to bear their specialized abilities on the progressive solution of these problems. These teachers conceive as their role and function the increasing satisfaction of the needs, interests, and problems of young people, and the resolution of tensions which are theirs.

4. In spite of this professed belief in such responsibility, these teachers avoid, for the most part, the very controversial and socially significant issues which represent areas in which young people must, or are extremely likely to deal. The issues avoided are, for the most part, those which are most significant in solution of the problems of society. Lack of pupil maturity, disapproval of parents, insufficient personal knowledge are listed as reasons for avoiding these issues.

5. Teachers expressed opinions on the relative weights of the two causative factors, environment and heredity, in producing racial and socio-economic differences; the immutability of human

nature in regard to development and maintenance of the institutions and ways of life; evolution and Man's place therein; control of scientific research for Man's welfare; universality of goods and bads; fatalistic determinism, supernaturalism, and the relation between traditional religious beliefs and science. A characteristic of the responses was inconsistency, contradiction, and confusion on each item, and a failure to apply scientific, pragmatic, materialistic attitudes, habits of thinking, or reasoning to the responses. No pattern of response, other than contradiction and inconsistency could be predicted in either instance.

6. The data indicate that teachers in schools for Negroes differ markedly in their opinions and professional preparation with teachers in schools for whites. Statistically significant differences between the opinions and professional preparation were apparent on every general question and in many specific instances. The cultural factors, the disadvantages of segregated schools and isolation from the mainstream of the cultural pattern, may be almost totally accredited for this situation.

7. Teachers are aware of the inadequacies in their preparation and consider present science education programs as more designed for preparation of doctors, engineers, research specialists and of little functional value to teachers; teachers suggest areas of specialization be set up to include more attention to study of, and research upon, growth and development of the human being; matters concerning sexual adjustment, marriage and the like; matters concerning food requirements and metabolic changes; mental health and hygiene; development of a coherent world view and ability to adjust conflicts in thinking which arise from scientific interpretations of the nature of the world, man, and society; more attention to propaganda analysis; more attention to conservation of human, social, and natural resources; more attention to solving and dealing with problems of consumer education, transportation, communication, consumer action, and governmental control of the productive process; more attention to the impact of science on society and the implications of science for development of modern industrial power age; more attention to principles of ethics which are consistent with the findings of science and are workable in a modern technological society; more attention to research conditions and methods which must be fulfilled before generalizations are made; more attention to controversial issues such as political questions of labor and government, control of resources, socialized medicine and racial prejudice; and more attention to the nature of man, his behavior, and his various cultures.

8. Teachers are concerned with present inadequacies in teacher education which stem from failure of the colleges to provide opportunities for prospective teachers to spend a considerable time in studying the needs, interests, and problems of children, their varying abilities and backgrounds, and developing competency to deal with

children who differ in their needs, interests, and solve problems in terms of varying abilities and backgrounds of experience.

9. Teachers feel there is need to spend more time in evaluating professional teacher preparation. Teachers wish to observe the application of educational theories in concrete situations, and state their concern over the disagreements on point of view and approaches which are presented in various courses.

10. Teachers express a concern and desire for the colleges preparing teachers to assume their role and function so that teachers may develop those competencies through which teachers may deal with socially significant controversial issues which are vital and real and important in everyday community life, and which are specifically designed to fully integrate the Negro people into American life.

CONCLUSION

The culture within which the Negro people operate is of such nature as to force on the Negro people a contradictory and inconsistent approach to the basic aspects of living in a democratic social order. This contradictory position and approach to everyday living is reflected in the confused and inconsistent opinions, beliefs, attitudes, and techniques which Negro teachers make to the vital problems with which young people must cope. Young people will deal with problems of sexual relations, venereal diseases, moral codes and ethics, conflicts between traditional religious beliefs and science, and other such problems whether or not they are provided with adequate and scientific evidences on which to make value judgments. Obviously, young people will make more mature and wiser decisions when they have scientific and valid bases for the making of decisions.

Teacher training institutions are faced with the necessity of providing opportunities to preservice and inservice teachers to overcome the cultural limitations and inhibitions which presently prevent participation of Negroes in American life. Teacher education institutions must provide teachers with the competencies and techniques for dealing with issues which are inimical to, or in conflict with, the prevailing cultural pattern. At present Negro colleges are not providing Negro teachers with such

competency and technique. Hence, these colleges function as the instruments perpetuating the prevailing cultural pattern, and preservice and inservice teachers are not only confused and contradictory in their opinions, beliefs, and patterns of conduct but are also actually incompetent to deal effectively with the problems of everyday living which are of most importance in the lives of Negro youth. The result is an educational and professional preparation of Negro teachers which is devoid of consciously planned experiences designed to develop within Negro teachers, opinions, beliefs, conduct, attitudes, techniques, and competency concerned with the socially significant and controversial problems and issues involved in being a Negro in the United States. Further, these controversial and socially significant issues are, at the same time, those very issues which are, for the most part, of most concern to the Negro people. They are the very issues whose solution would solve many of the important problems of American democracy.

IMPLICATIONS

Traditional fields of specialization are fields which grew up as research revealed new knowledge in more specialized form. The practice of studying from the general to the narrowly special in order to gain research competence neglects the needs of teachers—needs which are quite different from those of the research specialist, engineer, or doctor. The marked difference between courses offered in science departments and the work teachers actually engage in indicates the inadequacy of the present science education program. Further, the proportion of research specialists, doctors, engineers is quite small, and does not warrant the distorted emphasis whereby science education programs are centered around preparation for professions other than teaching in many colleges.

This does not mean that specialization is being abandoned, or that more doctors, engineers, and research specialists are not needed. In fact, the advantages of speciali-

zation is exactly the point in question. What is needed is a science education program designed specifically for the specialization of teachers, just as at present science curriculum offerings are designed specifically for preparation of doctors, engineers, and research workers. Teachers with science education background must deal, with young people, with the needs, interests, and problems of the individual and society. Present science education curricula do not provide such preparation.

RECOMMENDATIONS

1. Science education programs should abandon their present emphasis on subject matter to preparation of teachers for a functional emphasis on the major areas of social living. The curriculum for teachers should include units or courses in such functional areas as research and analysis of the needs, interests, and problems of the people indicates as important and necessary in the preparation of teachers in schools for Negroes. This demands a program of research in science education designed to ascertain those areas of functional living, and preparation of unit and course materials for teaching in these areas on the college level. Such course-unit materials should utilize community resources, and operate on a core, integrated, functional basis.

2. Science education programs for teachers should be so designated and distinguished from programs of preparation for medicine, research, and engineering.

3. Educational and professional courses should be so reorganized as to provide adequate and consciously planned opportunities for preservice and

inservice teachers to gain experience in the analysis of the role of the school in the community. Preservice and inservice teachers should be provided with skills and competency to use the educative process in solving community problems.

4. Science education programs should consciously and deliberately and adequately provide opportunities for prospective and inservice teachers to develop scientific, realistic, materialistic opinions, attitudes, beliefs, and patterns of conduct about socially significant and controversial issues, including as one common approach, the role of the Negro people in the American culture, and the interaction of the Negro people and impact of culture on the Negro people. Significant and controversial issues and areas of living should include development of opinions and value judgments in areas such as racial and ethnic differences, socio-economic differences, immutability of human nature, evolution and man's place therein, control of scientific research for benefit of mankind, universality of goods and bards, supernaturalism and fatalistic determinism, and the social function of science. Students should be provided with techniques and competencies for dealing with problems which arise in everyday life to which science has a contribution to make in way of solution.

5. The professional education of teachers should be organized around functional areas of social living and scientific specialization in areas such as life and environment; human growth and development; reproduction, mating, and sex responsiveness; the nature of the physical universe and changes through time; human nature; production, distribution, and consumptions of materials and energy; health; human physiology; communicable diseases; consumer education; propaganda analysis; scientific world view; man's position in the world of living things; the social function of science; and political questions arising from the impact of science on society.

SUGGESTIONS FOR TEACHING SELECTED MATERIALS FROM THE AREA OF THE INTERRELATIONS OF LIVING THINGS AND THEIR ENVIRONMENT WITH PARTICULAR ATTENTION TO PROBLEMS OF GOOD LAND USE

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THIS strange title—which has already consumed a considerable portion of my allotted twenty minutes—can be very simply explained. For it is also the title of an unpublished manuscript, completed in 1943 as one of the “Suggestions for Teaching” monographs, planned and prepared by the late Bureau of Educational Research in Science, at Teachers College, Columbia

University. These monographs accompanied, in certain instances, corresponding volumes in the “Science for Modern Living” series, written for the Bureau by invited experts. The “... Good Land Use” monograph was designed to accompany Paul Sears’s book, “Life and Environment,” which should be well known to any one professionally concerned with the

improvement of science teaching in general education.

Now while the Bureau was at work, an era in American history was passing. Between the latest rewriting of the monograph (in 1943) and the reading of this paper (in 1948), the passing of that era—call it pre-atomic, Roosevelt, or what you will—has become recognizably complete. (Which of you has been so inactive a citizen of the republic or so irrelevant a teacher of science in general education that he has not felt this turn in events, not only vaguely but concretely, in the form of unpleasant interferences with his living and his working?) Obviously I assume that the science teacher neither works nor should pretend to work in a social vacuum, independently of the developing crisis of the social order. I further assume that it is proper and should prove instructive to examine, if only briefly, the context of social change within which we have been and are attempting to advance our professional efforts.

There is both something persistent and something ever new in what we try to accomplish. The persistent component derives from at least two sources: the stubborn continuity of unsolved problems and the slowly growing core of tested theory and practice. The ever-new component derives from at least three sources: the emergence of unprecedented problems, the infinite variety with which continuing problems present themselves, and the recurrent revisions of our theory and practice as our endeavor matures. All this is well illustrated by the history of science-teaching in general education, perhaps especially when that history is viewed in the context of social trends.

How can the era that has just passed be best summarized for this purpose? It began, as I am defining it, with the descent of the American economy into the Great Depression; with perhaps twenty million Americans seeking employment in vain; with the bankruptcy of a Presidency hesitant about intervening; with the publication

of the "Recent Social Trends" report of the President's Committee which had engaged some of our leading social scientists in documenting how "cultural lag" generates social problems; with the publication of the Thirty-First Yearbook of the National Society for the Study of Education that redirected attention to the responsibility of educating all the children of all the people in the scientific processes of problem-solving, throughout the years of public education; with Mr. Roosevelt entering the White House; and with, in far-off Manchuria—no larger, as is said, than a man's hand—the cloud of military aggression in defiance of the predictably impotent League of Nations.

The era got under way by trial and error. Unusual, improvised, and often contradictory measures, executive and legislative, brought a reversal in the trend of the national economy. A vast political ground-swell developed, lifting millions of citizens into a rediscovery of their direct concern with political action, a great majority of them into the popular coalition that supported the emergent domestic and foreign policies of the New Deal throughout the longest administration in the history of the republic. Panic and despair gave way to the courage and confidence that characterize even first efforts to use scientific and democratic processes in problem-solving. (In Germany, the Nazi Party, led by Adolf Hitler, came into power, committed to preparing and executing the most dangerous conspiracy of all time against the democratic experiment, in Germany and everywhere in the world.)

Yes, I characterize the era just passed as *an era of problem-solving*—problem-solving that stirred the people deeply, involving them at their grass (and concrete) roots and relating the work of scientific men in a fresh, direct way with the grievances and aspirations of the people.

Now problem-solving begins with the identification of the problem. The data were available and, even after partial economic recovery, could be interpreted to

mean "one third of a nation ill-housed, ill-clad, ill-nourished," by modern, scientific criterions of good housing, good clothing, and good nutrition and in an era when there is "enough and to spare"—as Kirtley Mather demonstrated¹—of resources and technics to sustain equivalently high standards of living and democratic institutions everywhere in the world, certainly in America. Further analysis ramified, of course, into a vast array of increasingly specific sub-problems, each requiring definition and, if not solution, at least remedial action. Anything like a comprehensive schedule of achievements and failures is not necessary or attempted here. Taken together, such achievements and failures constitute the labor, farm, and social legislation of the New Deal.

How this bears upon the argument of this paper can be readily summarized. Working people were encouraged, especially by the Wagner Act, to build unions of their own choosing, in order to bargain collectively with their highly organized employers. The resultant organization of the basic industries provided the American people with their single, most powerful bulwark against indigenous fascism. (They need that bulwark.) Farming people were encouraged to join together in cooperatives and in local planning committees, to reverse the rural trends toward tenancy, top-soil destruction, and poverty. The people of the Tennessee Valley were encouraged to participate in democratic planning processes for developing the resources of the river valley according to a unified and long-range strategem for improving their way of life.² The people of the great cities were encouraged to organize local housing authorities for the purpose of replacing slum areas with housing projects designed to agree with long-term master plans for the thoroughgoing reconstruction of our cities.

¹ Kirtley Mather. *Enough and To Spare*. Harper and Bros., New York, 1944.

² Ellis Hartford. *Our Common Mooring*. University of Georgia Press, Athens, Georgia, 1941.

The people generally began to appreciate that freedom and security are not alternatives, to be bargained for, one against the other. They began to enlarge their conception of the *conservation of natural resources* to embrace the *rationale of comprehensive planning*—local, State, regional, national, world—for the development of *all* resources—natural, technical, and human. They understood Pare Lorentz when he asserted (in the sound track for the documentary film, "The River") that planning for water requires planning for the land and, inescapably, planning for and by people. They began to recognize, in the face of the mounting challenge to democracy, at home and abroad, that the Bill of Rights of 150 years before is in no sense an obsolete document; on the contrary, that it requires extension to include what 150 years of scientific work and continuing industrial revolution have made possible and necessary—a new bill of economic rights for the American (and any other) people.³ The two traditional freedoms—of speech and religion—have become supplemented by two new freedoms—from want and from fear. The people began to know that it must become their prerogative to institute as comprehensive a system of social security as ever they might find possible and desirable.

Finally, the people were enabled to identify their enemy—and let no one assume that the people have no identifiable enemy!—by his consistent interference with their problem-solving processes; abroad in the shape of fascist governments openly conspiring to defeat the democratic experiment everywhere; at home in the shape of an inexorably concentrating, private economic power⁴ institutionally driven to defeat the democratic experiment, first, in America, and then, everywhere. For in

³ National Resources Planning Board. *Post-War Agenda*. United States Government Printing Office, Washington, D. C., 1942.

⁴ Franklin Roosevelt. *Message to Congress of April 29, 1938*. Senate Document 173, 75th Congress, 3d Session. United States Government Printing Office, Washington, D. C.

the wider world, nation after nation lost its independence under fascist attack and at home the struggle for and against solving the crucial social problems in the interest of the greatest number rapidly deadlocked. The interrelations of foreign and domestic policies were revealed, as the struggle to formulate them soundly proceeded with greater and greater difficulty.

It was, I argue, an era of problem-solving that had run into a fateful impasse even before the fires of the Second World War had leaped back to sweep the continent of Europe. And in this era of problem-solving a great educational ferment was working. When the people begin to learn such fundamental lessons *outside* the schools, they find, among their resources, those professional workers *within* the schools who are specially educated or educable in the scientific spirit and the democratic faith. Challenged by the great need for identifying and solving crucial social problems and by the fascist challenge to reason and democracy, these professional workers came to recognize how scientific and democratic processes are, in coordinated development and application, the single, most powerful resource of the people. They also recognize how the educational and planning processes lie inevitably at the very heart of the people's effort to use scientific and democratic processes in their own enduring interest.

My argument, then, is that the significant developments in the recent general education movement came out of the vast energy and inspiration of this flood-tide of active, democratic experiment in the solving of problems. In this light I can understand the historic series of reports prepared by the Educational Policies Commission of the National Education Association, culminating in their *Education for All American Youth* which clearly outlines the shape of things to come if the people can resume once more their great endeavor of the 1930's. In this light too I can understand the publications of the Progressive Educa-

tion Association, in particular, their *Science in General Education*, which, starting from a psychological analysis of the needs of adolescents maturing in a society struggling to become democratic and emphasizing the worth of the unduplicable individual, sensitively integrates the science teaching and guidance functions of the school. In this light too, I can understand J. D. Bernal's redefinition of the kinds of problems—"real, significant, and interesting"—that might properly concern the science teacher and his students.⁵ In this light too, I can understand the work done for the Bureau of Educational Research in Science by the cooperating teachers, the resident staff, and the invited experts. In this light too, I can understand the report published in 1942 on *The Education of the Science Teacher* for the American Council of Science Teachers, for in this report the responsibilities and the consequent competence of the science teacher were reappraised and the fields of undergraduate and graduate specialization were functionally redesigned around the problem areas of the modern world and integrating the resources of hitherto discrete disciplines. Finally, I can understand in this context of an era in which the people were actively involved in problem-solving, the rise of the workshop as an institution for the continuing, in-service education of science teachers. In these workshops, the teachers, freed from all conventional academic requirements, were assisted to direct their teaching to the needs of particular young people growing up in specific communities where organized projects for community-improvement could be expected to capture the imagination of the people resident therein. And these workshops were provided with the literature relating to the study of young people and of communities, with opportunities for first-hand community observation, and with consulting experts recruited from every source—university, government, or other—that

⁵ J. D. Bernal. "Science Teaching in General Education." *Science and Society*, Volume IV, Number 1, Winter, 1940.

proved relevant. Truly, an educational ferment was at work in the social context of problem-solving by the American people.

Into Paul Sears's "Life and Environment" and into the ". . . Good Land Use" monograph were integrated much of the thought and enthusiasm of this exciting era. The book presents to the science teacher and to the scientifically literate adult the social and philosophical significance of the relatively young science of ecology, the science of the interrelations of living things and their environment. The monograph represents a delimitation of the vast scope of this science, in application to the problems—urgently concerning the people at the time—of making the very best use of that fundamental resource, the land. With that delimitation to problems of "good land use," the monograph clearly broke with the traditional compartmentalization of the curriculum. And although a reading of the monograph might at first convey more meaning to a teacher with a background in biological science or geography or sociology, its challenge deliberately includes every specialist in the usual faculty and additional specialists from the larger community served by and serving the school. This relevance of many specializations to the analysis and solving of a problem is, in fact, one important criterion for judging the reality, the significance, and the probable appeal of a problem.

The monograph has a structure very much like that of any of the published monographs in the *Suggestions for Teaching* series. An introductory chapter reviews the major generalizations derived from ecological and social theory, relating man—his coming, his diverse cultures, his varying fortune, his current well-being, his possible accomplishment—to the immediate world, the earth's surface within which he lives. The responsibilities of the teacher are defined by inference from the social functions of the ecologist as reported by Sears: (i) to remind all citizens continuously of the physical basis on which civili-

zation rests; (ii) to determine whether constructive or destructive change predominates in the soil of a given region; (iii) to determine whether the course of the water cycle in a region is working toward or against greater biological productiveness; (iv) to determine the opportunities and limitations of the climatic pattern; and (v) to teach the principles of community development so that man can more effectively manage his own community within the context of the region and the world of which it is a part. There, in outline, is the science of unified river valley development!

The introductory chapter includes a statement of the emerging theory of conservation and reviews (as of 1943) the experience of the American people in developing techniques for planning the good use of the land, both in rural and urban communities. The rural program had gone forward under the auspices of the United States Department of Agriculture. The urban program had been sponsored primarily by the United States Housing Authority.

The second chapter analyzes the interests that young people develop concerning the interrelations of living things and their environment. It compiles a rich array of appropriate learning experiences in this problem area, under the headings of field work, reading, audio-visual aids, consultation with experts, "laboratory" work, discussion, and the preparation of reports. Throughout, the emphasis is unconventionally placed upon learning through action in the community for the solution of genuine problems.

The third chapter presents an analysis of possible teaching objectives with a representative collection of evaluating instruments. Changes that may take place in the young people are classified under attitudes, world view, action, technics, and information. Objective and non-objective tests are included, together with an exposition of technics for constructing such tests.

Changes that may take place in the community are also considered as proper teaching objectives.

A fourth chapter reports three actual teaching experiences in this area that were designed and carried through by three of the class room teachers that cooperated with the Bureau.

A final chapter compiled "some aspects of good land use that merit further study by the teacher" which accumulated as a result of the studies made by the resident staff of the Bureau. They were grouped under the following headings: the soil as a key resource, soil erosion, American agricultural experience, the city as a community among communities, toward good land use in the urban-rural community, and comprehensive social planning. As a result of this study, it was hypothesized that the appropriate community for recognition by the students of a senior high school, who are considering first-hand observation and projects of actual community improvement, be defined as an *urban-rural community*, emphasizing the ecological, economic, and cultural interrelations of city and countryside and limited only by the possibilities of travel back and forth from the school-as-community-center.

The monograph was provided, of course, with a generous and annotated bibliography of sources—publications, agencies and organizations to be consulted, and audiovisual aids to learning.

I consider that this manuscript represents an implementation of the theory of general education that developed in the brief era of democratic experimentation with the solving of problems. Perhaps it represents the kind of work that will need to be done again and much more extensively, all along the frontier of our continuing experience as a people.

By the time the ". . . Good Land Use" monograph was ready for the press, the nation was deeply involved in a necessary but unprecedently comprehensive war effort and it was quite evident that the con-

tinuing deadlock in the struggle for political power in America between the people seeking the opportunity to continue their problem-solving and the minority opposing them would not be resolved one way or the other "for the duration." The foreword that was prepared for the manuscript self-consciously but soundly argued the continuing validity of conservation, of teaching directed to the problems of good land use, and of social planning.

The peoples of the one world won the war but have yet to secure an enduring peoples' peace. The problems of these transitional years are extraordinarily difficult and the central problem has become, perhaps, the reconquest politically by the people of at least their former prerogative of continuing peacefully the solving of their problems. In this interval of temporary retreat, perhaps a special responsibility devolves upon the schools and schoolmen of the nation, to maintain—within a necessary context of vigilantly defended freedom of inquiry—the great traditions of problem-solving in the scientific spirit and the democratic faith. While there is some evidence that educators are not at all well prepared to recognize and to defeat attacks upon the freedom of the schools, there is also evidence that many scientists and teachers are vigilant and competent in this defense.

That this matter of freedom of inquiry can be predicted to become a very genuine issue follows from the very controversial character of any "real, significant, and interesting problem." Such a problem has both technical and political aspects and its solving requires both scientific and democratic political technics. (This is also why the integration of the natural and social sciences as the very core of the continuous problem-solving component in general education seems clearly indicated.) The whole issue is very familiar to teachers who have debated whether or not a learning experience should be permitted to extend into the realm of controversy. Since controversy characterizes the world of men it would

appear reasonable to argue that citizens should become well acquainted with controversy, especially under responsible educational auspices. And would it not be a veritable abdication of one's responsibility as a teacher to limit a study of soil conservation to the field technics while ignoring the contemporary struggle of the Farm Bureau to destroy the Soil Conservation Service of the United States Department of Agriculture?⁶

Or, to consider one other example of the difficulties attending the use of science for the people, it might be instructive to review the discussion in which Robert Lynd of Columbia University pointed out to Paul Sears how science itself has become a key weapon in the struggle for power that pervades the nation.⁷ The social scientist and the natural scientist working together make a powerful pair; working wholly independently, they run the separate risks of naïveté.

Any long-range democratic strategy must provide for the slow but certain consequences of improved teaching in general education. But we are living in a new era, within which mankind faces literally fatal issues. It is the area of the struggle to unite or to split the one world community

⁶ Angus McDonald. "Farm Bureau v. Soil Conservation." *New Republic*, July 14, 1947.

⁷ Jerome Nathanson, ed. *Science for Democracy*. King's Crown Press, New York, 1946.

so long in growing. It is the era of non-conventional weapons of mass destruction: the well-publicized atomic explosives and the less-publicized ecological technics by which the destructive intervention of military man in the precariously balanced interrelations of living things and their environment has reached an unprecedented power. Pestilence among men and their domesticated animals together with organized failure of the granaries of the nations might conceivably end the dominance and perhaps the survival of the human species upon this planet. One is led to reexamine in horror the theology—if such there be—by which a holy world of one-half of the world community against the other could be advocated, if the consequence could be the end of the human adventure in our time. The warning of the nuclear physicists—"one world or none!"—makes sense to the ecologist.

The teacher as teacher has a significant assignment in continuing the education of all the children of all the people in the scientific and democratic processes of problem-solving. The teacher as citizen has an equivalently significant and perhaps more urgent task, to participate energetically with his fellow citizens in courageous and intelligent political action designed to regain once more a time of problem-solving by the people in their interest.

AGRICULTURAL SCIENCE TO SERVE YOUTH

WARREN P. EVEROTE

Encyclopaedia Britannica Films, Wilmette, Illinois

THE EXPERIMENTAL COURSE

ABOUT ten years ago, your speaker developed and presented an experimental course¹ in the science department of a Los Angeles high school. The title "Chemistry" was assigned to it, and although this title did not define the course

¹ Everote, Warren P. "A Course in Practical Chemistry for High-School Students." *School and Society*, 54: 447-449, November 15, 1941.

adequately, it made the course administratively acceptable and provided it with a place in the program of school offerings. The course might have appropriately been called "The Sciences in Community Service" since it dealt with problems in the Los Angeles environment.

Here are some examples of the problem areas or units studied in the experimental-science course at different times during a

three and one-half year period: Mineral Resources in Southern California, The Los Angeles Water Supply, Making Photographic Records, Petroleum in War and Peace, Agriculture in Southern California. Seventeen different units were studied during the entire period. Some of these units, such as Agriculture, were repeated in different semesters. Specific problems within each unit were related as much as possible to five centers of interest: The individual, the home, society, industry, and recreation. These centers of interest, although overlapping in some respects, were useful in organizing and developing the studies presented in class.

Experiments and demonstrations used in the course were based upon standard published procedures, revisions of standard procedures, and still other procedures devised by the instructor. About one-third of the total class time was used for laboratory work and demonstrations.

Assignment work, other than the laboratory type, occupied about one-half of all class time. Some assignments were studied by all members of the class. Others were planned specifically for individuals or small groups. In general, assignments for all members of the class involved the collection of data and the subsequent evaluation of these data. The intention was to teach students to use pieces of information selected from any of the sciences as tools in developing insights, understandings, and adjustments pertaining to the problems being studied. Individual assignments were planned primarily for work being done on special problems which were continued throughout the course. They were described as term problems.² In both class and individual studies, data were drawn mainly from contemporary sources such as science magazines, trade papers, advertisements, journals, monographs, and newspapers.

² Everote, Warren P. "Term Problems in Secondary School Science." *SCIENCE EDUCATION*, 27: 33-36, February, 1943.

Professionally-produced motion pictures, still pictures, models, and other instructional aids were used extensively. A number of still pictures and models were conceived and developed by the students themselves. Field trips were made into the surrounding community.

THE RESEARCH STUDY³

As a means of measuring the development of student understandings and perspectives arising out of the course, one unit of work was selected for intensive study. This unit was *Agriculture in Southern California*. At the beginning of this unit students were asked to express agreement, disagreement, or indecision on each of seventy issues presented in the form of an opinionnaire. For example, they were asked such questions as: Do you think that a farmer, in order to operate a modern farm successfully, requires an educational background comparable to that needed by a professional scientist? Do you think colored peoples, such as Negroes and Mexicans, should be allowed to own farmland in Southern California? After studying problems of agriculture during a six-week period, the same opinionnaire was again presented to the students. Pre-unit responses were then compared with post-unit responses.

The changes in student opinion were measured, analyzed, and found to be statistically significant. In general, these changes favored large-scale planning in agriculture and showed an increased student awareness of the significance of scientific data and techniques; and the roles of scientists, lay citizens, and students in large-scale planning. Furthermore, the students showed growth in understanding the interrelations of rural and urban peoples, especially the interrelations that have been brought about by technology. A coefficient of 0.87 was shown to exist

³ Everote, Warren P. *Agricultural Science to Serve Youth*. Contribution to Education, No. 901, Teachers College, Columbia University, New York, 1943.

between opinions expressed on the individual student's opinionnaire and the opinions expressed by the same person in his term-problem report. Student use of reference materials in the preparation of class reports and term problems was found to be closely related to opinions expressed. That is, those who used the greater variety and number of reference materials showed the greater amount of change in the opinions expressed. These changes were analyzed and judged to be desirable in terms of fostering useful perspectives and attitudes.

A second aspect of student growth was also studied. This consisted of an analysis of the grade-point improvement in all high-school courses taken coincident with, and following enrollment in, the experimental-science course. Stated briefly, a group of 230 students who enrolled in the experimental-science year course was paired with a control group of 230 other students who enrolled in a traditional-science year course. Individuals in the two groups were matched on the basis of intelligence quotients. Gains in the grade-point means of the experimental group proved to be reliably greater than gains in the grade-point means of the control group. Discrepancies in grading between the two science courses could not have been the deciding factor since the total number of grade points earned in science by the 230 control students slightly exceeded the total number of grade points earned in science by the 230 experimental students. The conclusion is that students in the experimental course registered significant gains in their over-all academic standing as a result of their experiences in the science course.

IMPLICATIONS OF THE RESEARCH STUDY

Your speaker, reflecting now on the significance of the experimental course just described, feels that some real progress was made. This progress was mainly in the direction of developing a more functional kind of science study. The experimental

course left many problems unsolved, but it did help reveal the value of a course in which the sciences are used to assist students in developing insights, understandings, and adjustments pertaining to problems in their everyday experience. And it indicates, too, the potential value of a science program constructed along lines similar to this experimental course.

The experimental course just described represents only a small part of the over-all science program suggested as an outgrowth of that experimental course. In the type of curriculum advocated, divisions corresponding to the units of the experimental course would become subject fields. Agriculture, for example, would be one subject field; Mining would be another; and Cosmetology still another. Each of these subject fields, of course, and others comparable to them in importance, would include units of study of their own. Chemiculture, truck farming, and the effects of technological changes upon agricultural laborers are examples of units in Agriculture. Each of these units was used as a topic for study in the problem area of the experimental course called *Agriculture in Southern California*. Units of this kind were selected justifiably because of their importance within the community in which they were to be taught. Later, other units will be suggested that could be directly related to the environment of any specified community.

A curriculum that contains subject fields comparable to Agriculture is consonant with the areas of functional interest on the adult level. In nearly all far-reaching and significant developments in industry, agriculture, medicine and other fields, we see the sciences being used as tools to help produce desired ends. The data and the techniques of the sciences are the essential elements in all of these pursuits. For example, in agriculture, phases of chemistry are utilized to help improve soil, kill weeds and insects, and prevent rot. Aspects of physics find application in tech-

niques applied to retard the escape of moisture from the soil, develop irrigation projects, and perfect machinery for harvesting crops. Principles of genetics are applied to the production of better plants and increased yields. Taken together, improved yields and better ways of harvesting these yields—both manifestations of applied science—are liable to engender important social and economic problems. Food may become cheaper, but agricultural laborers may be thrown out of work. Thus social changes arise out of technological advances such as these in agriculture, and such changes require consideration in the science studies as well as in the social-science studies. At present, the possibility of a new dust bowl in the Southwest's wheat belt is an important factor in shaping the policies of our leaders who are attempting to feed the world adequately. Handled in their proper context, considerations even as broad as this can be made meaningful and useful to the youth of our secondary schools. Youth should learn how such social problems are solved. How well this is done depends upon how well individuals and groups of individuals are trained and how well they can use the sciences to produce useful results. Our young people must learn to recognize that many problems of world-wide significance are actually present in their own immediate environments. It is essential that young people learn early to identify themselves with such problems and learn how to react effectively to them.

To consider more fully the implications of a curriculum made up of subject fields like Agriculture, it seems appropriate to consider some of the problems inherent in its organization and presentation. To begin with, who should select the subject fields, and who should select the units to be studied in each field of the science program called for? In the experimental course previously discussed, the instructor made the selection of the units and the topics for study. But this approach, even

on the limited scale of a single experimental course, has limitations. One effective method for selecting courses would be the collaboration of competent curriculum workers with competent instructors. Selection of any subject field to be introduced in a given school should be based upon the significance of that subject in the environment of the community where the school is located, and upon its applicability to the maturity level of the students being taught.

The units undertaken in a course such as Agriculture are of great significance. The curriculum department should prepare a list of appropriate units and a variety of suggested treatments that might be used by the instructor. The final selection of specific units would be decided by the instructor to suit the special needs of his students. He would also improvise and develop units as he saw fit. So, too, it would be his province to decide upon the specific assignments within each unit. The adequacy of the assignments selected would depend largely upon his skill, his training, and his experience; and upon the immediate significance of the problems presented.

As noted earlier, class assignments made in the experimental course stressed the collection and subsequent evaluation of data from many sources. Some of these data were obtained from personal contacts with people in the field, some from radio programs, and some from publications. In the experimental course we have learned, too, that significant and desirable changes in student opinion were related to the number and variety of sources of information consulted. This seems to indicate that students studying problems derived from their immediate environment apparently need a great deal of information which must be drawn from current sources if they are to formulate effective responses. The implication here, from the standpoint of the administrator developing the suggested science program, is a need for expanded library facilities. The implication

from the standpoint of the instructor in any of the subject fields is the need for more stress on teaching students how to locate appropriate sources of materials, how to select data from these sources, and how to organize, evaluate, and act upon, or otherwise utilize these data.

Thus, courses, units within courses, and assignments pertaining to the units should all be related to the immediate environment. It will become increasingly important to establish relationships with the community outside the school—relationships which will permit students to spend part of their school time in the community studying and working. In some schools, such arrangements are already functioning effectively. In this manner the experiences provided by the community supplement the experiences provided by the classroom.

Laboratory work is one of the most essential parts of a course such as the one described here as Agriculture. In the experimental course the instructor recognized the need for assistance in developing experiments and demonstrations. He was fortunate in obtaining collaboration from staff members of the University of California at Los Angeles who were interested in the project. This procedure was used because it was the only immediate way of getting the work done. A better arrangement would be one in which useful experimental procedures for a given course were developed cooperatively by science instructors and members of the curriculum department. In some cases, the collaboration of a subject-matter expert might be required but only as a check on the accuracy of the resulting experimental procedure.

The use of instructional aids is another important part of the over-all development of such courses. Much time can be saved and important results achieved by using motion pictures, slides, filmstrips, and models. For example, through the medium of a motion picture, a given experi-

ence can be shared simultaneously by all members of the class. That experience can then be used as a common springboard to further study by the entire group. By means of animated drawings and other special techniques, motion pictures can reveal significant actions and clarify concepts that would be difficult and, in some cases, impossible to demonstrate in any other way regardless of the skills the instructor possesses or the facilities he has available. For example, consider the growth of a plant. The movements of plant growth take place too slowly for the unaided eye to signal continuous changes to the human brain. By means of time-lapse photography, the entire cycle of growth can be represented as a single continuing process in a very few minutes. Or, suppose that it becomes desirable to show the movement of raw materials into the growing plant, movements such as the intake of carbon dioxide, the production of food materials in green parts of the plant, and the excretion of certain materials through the stomata. With the use of animated symbols, these actions can be visualized as accurately as human knowledge will permit. The collection and distribution of films and models on any large scale requires skillful planning so that materials are available when they are needed in each specific course. And the program of teaching instructors to use such aids effectively and efficiently must be pushed ahead for in-service instructors as well as for those in training.

The prospective instructor for any of the courses such as Agriculture needs special training designed to help him become a competent observer and a skillful teacher with literacy in several of the sciences. In addition, he should have experience in applying data and techniques of science in many different aspects of his environment. College training for the prospective instructor should be directed specifically toward making him an expert teacher, not a geologist as such, or a chemist, or a

biologist, or any other subject-field specialist in science. For him, a college survey course has the most value. This kind of course is as important to him as is physical chemistry for the prospective chemist or atomic physics for the prospective physicist. It is also essential for him to receive training in child development, in psychology, and in the humanities. More actual teaching-practice should help him perfect his techniques of teaching and develop his background of understandings useful in various subject-fields. More attention will need to be given to teaching him how to cooperate effectively with other instructors in science, and with instructors in other fields such as social studies. In short, training to be a competent instructor in the kind of science service described, means training to be a specialist in helping youth apply the knowledge and techniques that we call science to the effective understanding of problems and phenomena in their environment. This program of training may require more than the present four-year course.

Although a pioneer course of the kind described earlier can suggest the direction to take for improving or changing the existing science work, important curricular developments on a broad front must arise out of the cooperative efforts of all the different groups of professional personnel— instructors, curriculum specialists, counselors, administrators, and professors entrusted with training prospective science instructors. Out of the experiences and interests of all of these people must be generated the enthusiasm and leadership needed to move toward the kind of science program suggested.

CONCLUSIONS

As pointed out in the original study, if such problems as Agriculture, The Utilization of Sources of Power, and Feeding the Community were to become subject fields on the secondary-school level, specific results might be expected. Two of these are described here:

(1) The guidance functions of the school would be improved. Guidance would become principally a matter of helping students clarify their capabilities and select courses to further these capabilities. Students entering the secondary-school program would not have to make a choice between general-education courses and college-preparatory courses. Since the secondary school would no longer be identified as a college-preparatory institution, no specialization would be expected. Each student would have the opportunity to study a number of relatively different subject fields or groups of related subject fields. Each field would consist of problems found in the environment. Student gains would be in terms of attitudes, understandings, and adjustments. It is reasonable to expect that this kind of secondary-school training would provide each student with a sound basis for making a vocational decision upon reaching a more mature level of development.

(2) The number and variety of practical experiences studied in the secondary school would increase many fold. Instead of being concerned almost wholly with discrete bits of scientific data, as in a typical science course, a course such as Agriculture would provide experiences based on real problems that exist in the environment. Data and techniques from the sciences would be drawn upon to help the learner understand and react effectively to the problems. Thereby, students would gain a wide range of experiences which will help them materially in attaining social adjustment at their maturity level. The practicability of a wide variety of experiences on the secondary-school level suggests the advisability of extending the program of secondary-school education through the fourteenth year. This, of course, is already the case in some systems.

Enough has been said to indicate some of the challenging problems attending the development of the kind of science study recommended as an outgrowth of the research study, "Agricultural Science to Serve Youth." To conform with the discussion presented, the title "Agricultural Science to Serve Youth" may now be changed to "Agriculture to Serve Youth." Agricultural science, as such, does not represent real life activities, but Agriculture does. So does Cosmetology, so does Mining, Photography, Aviation, and many other subjects. The sciences as such are bodies of information and techniques apart from these life activities. But by using selected materials and techniques from the sciences as basic tools, we learn to understand and interpret the problems in a field such as Agriculture.

Along with their great destructiveness, our recent wars have given us some values of a constructive nature. Under the stress of wartime urgency, scientific work helped advance medical service; helped develop transportation facilities in the atmosphere, on the earth and under the seas; and helped improve the instruments and techniques of communication. Our youth faces the ever-enlarging world of human behavior implicit in such advances as these. Life is becoming more and more intensively active, and our youth are involved in that activity. They cannot be inactive. They

must grapple with problems of health, of transportation, of communication, and of other fields affecting human life. Youth must be prepared to cope with political issues, with labor troubles, with the economics of living, with home life, and with recreation. These problems and many more are vital in human living. Knowledge and techniques drawn from the sciences are essential in every one of them. The welfare of humanity depends upon how effectively people can use this knowledge and these techniques to serve the needs of humanity.

MATERIALS OF CONSUMER SCIENCE

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THE DEVELOPMENT OF CRITERIA FOR CONSUMER EDUCATION

THE purpose of this particular investigation was to select and organize, from periodical literature, materials of consumer education which were suitable for integration into seventh, eighth and/or ninth-grade courses of general science.

If materials of consumer education were to be integrated effectively with the subject-matter now constituting the courses offered in our public schools, it became necessary, as the first step, to secure a definition, a set of criteria, or some other designation, which indicated unquestionably what is consumer education. A search was therefore made through approximately 175 masters' theses, doctors' dissertations, articles in periodicals, and books, for all the definitions and criteria of consumer education which they contained.

This search brought to light in a study by Klautsch,¹ an outline which seemed likely, with necessary modifications and additions, to serve as a set of criteria for consumer education which would prove

¹ Adolph A. Klautsch, *The Organization and Administration of Consumer Education*, Unpublished doctor's dissertation, University of Illinois, 1943, pp. 24-34.

satisfactory for use in the selection of materials in that field.

The adequacy of Klautsch's outline for this purpose was then tested by analyzing the subject-matter in four issues each of *Consumers' Guide*, *Hygeia*, *Good Housekeeping*, and *Time*. The analysis was made in the following manner:

The entire contents of each of the issues, except advertisements, letters of opinion to the editors, and materials classified in the table of contents as fiction, were carefully read. An attempt was made to identify, with one or more sub-points of Klautsch's outline, every statement which met one or more of its major points. Whenever any portion of the material could not be thus identified, the outline was modified or enlarged sufficiently to enable the identification to be made. The resulting outline, stated in the form of criteria for selecting materials of consumer education, is as follows:

For the purposes of this investigation, an item is considered to be an appropriate part of consumer education if it provides guidance and/or instruction

- A. In making a wise choice of goods and services on the basis of
 - I. Necessity as contrasted with luxury.
 - II. The place of the purchase in the budget.

- III. Their health values.
- IV. Other standards of value, than health.
- B. In deciding efficiently
 - I. How to buy.
 - II. When to buy.
 - III. Where to buy.
- C. In using goods and services so as to secure
 - I. Efficient operation.
 - II. Maximal "life."

It was obvious that this set of criteria could not be used effectively unless the terms "goods and services" were satisfactorily defined or delimited. A search was therefore made through the literature to determine what goods and services should be included in consumer education.

Thirteen publications from among those already analyzed were found to give designations of "goods and services." A final list was developed by a trial and error process. Minor aspects designated in the sources were combined to make more and more broad and inclusive designations of goods and services. For example, "Home Furnishings," "Home Maintenance," and "Home Heating," which had been listed in three different sources, were considered to be minor aspects of the "Equipment and Maintenance of the Home." Eight designations of areas were thus built up and these included all "goods and services" named in every source.

This list was then tested for adequacy by analyzing with it the same materials by the same technique as had previously been used in testing Klautsch's outline. As this work proceeded, it was found desirable to make minor modifications in the list.

The master list of eight resulting "areas of goods and services" were these:

1. Food.
2. The Equipment and Maintenance of the Home.
3. Clothing, Textiles and Clothing Furnishings.
4. Health and Personal Care.
5. Transportation and Communication.
6. Leisure and Recreational Activity.
7. Education.
8. Savings and Investments.

The next step in this investigation was to determine the reliability and validity of the criteria when they were used for selecting from periodical literature materials dealing

with consumer education. It was decided to use repeated and group judgment in determining respectively the reliability and the validity of the criteria when actually used in selecting such material.

Two issues each of *Consumers' Guide*, *Hygeia*, *Good Housekeeping*, and *Time* were selected at random for the determination of reliability. Every article in each copy of the magazine was first read and evaluated on the basis of the criteria in order to determine whether that article, or any section of it dealt with any phase of consumer education.

The first evaluation was made by the investigator on February 16 and 17, 1947; the second on March 17 and 18, 1947. It was assumed that the lapse of one month between the two analyses would eliminate, to a sufficient extent, whatever practice effect there might be.

When both analysis had been completed, a coefficient of correlation was computed between the results using the tetrachoric diagram method described by Thurstone.¹ The tetrachoric coefficient of correlation between the two analyses was found to be $.93 \pm .02$. It seemed reasonable to assume that the criteria for selecting materials of consumer education from periodical literature had a sufficiently high reliability.

The validity of these criteria when used to select materials for consumer education was then determined. Five advanced graduate students in the School of Education at the University of Michigan carefully examined all the articles in the same magazines used by the investigator in his two analyses and indicated their judgments on tabulation sheets provided. The designation given each article by a majority of the judges was considered to be the judges' composite designation of that article. A coefficient of correlation was then computed by the tetrachoric method between the judges' composite designations and

¹ Leone Chesire, Milton Saffir and L. L. Thurstone. *Computing Diagrams for the Tetrachoric Correlation Coefficient*. Chicago: The University of Chicago Bookstore, 1933 (unpaged).

those given by the investigator in his first analysis of the articles.

The tetrachoric coefficient of correlation was found to be $.82 \pm .05$. It seemed reasonable, then, to assume that the criteria for selecting materials of consumer education from periodical literature had a sufficiently high validity.

THE SELECTION, ORGANIZATION, AND EVALUATION OF MATERIALS OF CONSUMER EDUCATION

The next step was to select and organize materials of consumer education and to evaluate their suitability for integration into seventh, eighth and/or ninth-grade courses of general science.

A study by Gabriel¹ provided specific guidance with respect to the selection of publications to be analyzed in order to obtain items dealing with consumer education. As a part of his survey of methods now employed in the teaching of consumer education in the public high schools of 24 states, Gabriel sent questionnaires to 1,000 teachers of that subject in public high schools. The responses revealed that supplementary materials were considered most effective for consumer education, and that the two kinds of supplementary materials used most frequently and regarded as most highly effective were magazines and government publications; and that of the supplementary sources named and thus evaluated, *Consumers' Guide* led the list.

Consumers' Guide was therefore selected as the one government publication to be analyzed.

It was deemed desirable, as a means of obtaining a variety of types of materials, to select for the remaining sources magazines designed for different purposes such as a health magazine, a women's magazine, and a news magazine. Gabriel's findings revealed that of magazines designed for health education, *Hygeia* was rated highest by the respondents; *Good Housekeeping*

was rated highest of the women's magazines; and *Time* was rated highest of the news magazines. It was decided, therefore, to confine the subsequent analysis to the issues of *Consumers' Guide*, *Hygeia*, *Good Housekeeping*, and *Time* published between July 1, 1945, and April 1, 1947.

All the articles, including those under various department headings, in the selected issues were examined with these exceptions:

1. Advertisements
2. Letters of opinion written to the editors
3. Articles and stories which the table of contents classified as fiction

Every article was read for the purpose of finding in it all the "knowledges of consumer education" it contained. A "knowledge of consumer education" was defined as any material that satisfied one or more of the criteria stated. In some articles these knowledges consisted of only a phrase or a sentence or two, and had only minor importance. In many others, however, several knowledges were found in a single article.

Every knowledge was recorded on a tabulation sheet under four headings: Magazine and Date; Page No.; Article Title, and Consumer Knowledges. For example: In *Consumers' Guide* for July, 1945, on page 11, was an article entitled "First Aid for a Sweet Tooth," which contained the knowledge, "Honey and corn syrup may be used in place of cane sugar in cooking and canning."

In the issues of *Consumers' Guide* examined, 267 articles were found to contain 544 knowledges of consumer education; in *Hygeia*, 232 articles were found to contain 582 knowledges of consumer education; in *Good Housekeeping*, 407 articles were found to contain 1,188 knowledges of consumer education; and in *Time*, 1,007 articles were found to contain 1,760 knowledges of consumer education, making a total of 1,913 articles containing 4,074 knowledges of consumer education.

¹ Puzant Gabriel. *Methods of Teaching Consumer Education*. Cincinnati, Ohio: Southwestern Publishing Company, Monograph 54, March, 1946, p. 45.

The 4,074 knowledges of consumer education varied widely in scope. Besides the variations in scope of the articles, there was extensive duplication of knowledges among them. It was, therefore, decided to combine the knowledges into major and mutually exclusive categories.

The following example illustrates how this combining was done. One of the articles, picked at random, which happened to be a question and answer, reads thus:

"Does heat affect canned foods?

"Canned foods stored in a warm place will not spoil, but there may be some loss in vitamin values. Studies indicate that the vitamin content decreases as storage temperature increases. The loss is not exceptional unless the cans are kept at high temperatures for some time. A cool cellar is best for storage."

The following category was tentatively constructed as an appropriate one under which to record the "consumer knowledge" extracted from the article:

"Storage conditions, with reference to moisture and temperature, for foods, in order to preserve nutritional values."

Subsequent attempts to allocate other knowledges revealed the need for a revision of this category. Such revision was made as often as was necessary as the work proceeded in order that the category would unquestionably include all the knowledges which logically seemed a part of it. The statement which finally resulted from this trial and error process is as follows:

"Optimal conditions of moisture and temperature for storing foods so that the maximal nutritional value may be preserved."

All of the 4,074 knowledges of consumer education were combined in this manner into 281 categories.

It was found that 62 categories were concerned with Food; 45 with The Equipment and Maintenance of the Home; 30 with Clothing Textiles and Clothing Furnishings; 70 with Health and Personal Care; 24 with Transportation and Communication; 21 with Leisure and Recreational Activity; 21 with Education and 8 with Savings and Investments.

A copy of the list of 281 categories was then submitted to three specialists in the teaching of science who, in addition to the investigator, evaluated every category with respect to its suitability for integration into seventh, eighth and/or ninth-grade general science courses.

The scale used was as follows:

- a. Essential for inclusion in the mentioned courses (value +2)
- b. Some positive value for inclusion (value +1)
- c. Neither well-suited nor poorly-suited for inclusion (value 0)
- d. Poorly-suited, rather than well-suited for inclusion (value -1)
- e. Totally unsuited for inclusion... (value -2)

The algebraic sum of the evaluations of each category was assumed to be the value of that category. On the basis of these results, the 281 categories were arranged in descending order of their values, within the groupings in which they had previously been placed.

Seven of the categories were judged as essential by all four evaluators, and so had a value of plus eight; 105 were judged as totally unsuited and so had a value of minus eight; 74 were given some positive value and 196 were given negative values.

THE ASSIGNMENT OF CATEGORIES OF CONSUMER KNOWLEDGES TO PRINCIPLES AND ATTITUDES

The last step was to assign the categories of knowledges of consumer education, judged to be of value for integration into seventh, eighth, and/or ninth-grade courses of general science, to scientific principles to the understanding of which they may be expected to contribute, or to scientific attitudes in the development of which they may be deemed likely to assist.

The principles of science selected for use were the 272 in the "composite list of principles of physical science" assembled by Wise;¹ and the 300 in the "master list of major principles from the biological sci-

¹ Harold E. Wise, *A Determination of the Relative Importance of Principles of Physical Science for General Education*. Unpublished doctor's dissertation, University of Michigan, 1941, pp. 248-91.

ences" assembled by Martin.² The scientific attitudes selected for use were the five major ones formulated by Curtis.³

Every principle and every attitude was typed on a separate index card and filed. Every category which received a positive value, as described in the preceding step, was typed on a separate slip of paper. The investigator compared every category with every principle and with every attitude in order to determine whether, in his opinion, the material it included could readily be made to contribute to the understanding of that principle or to assist in the development of that attitude. In every case in which such a relationship was discovered, that category was assigned to that respective principle or attitude.

Some of the categories might have been assigned to more than one attitude or principle. It was, however, arbitrarily decided to assign every category to only that principle or attitude with which the relationship was most obvious.

The defensibility of these assignments was checked in two ways:

As a first check, the general science texts written by Caldwell and Curtis, Watkins and Perry, and by Powers, Neuner, Bruner, and Bradley were chosen because they are organized so as to develop understandings of scientific principles and possession of scientific attitudes. The indexes of these books were consulted in order to find the pages on which were presented any of the various topics with which the categories dealt. These pages were then examined in order to determine the principles and/or the attitudes these topics were used to develop.

It was found that the topics were in-

² William E. Martin. *A Determination of Principles of Biological Sciences of Importance for General Education*. Unpublished doctor's dissertation, University of Michigan, 1944, pp. 111-57.

³ Francis D. Curtis. *Some Values Derived from Extensive Reading in General Science*. Teachers College Contributions to Education, No. 163. New York: Teachers College, Columbia University, 1924, pp. 41-9.

cluded under essentially the same principles and/or attitudes by the textbook writers and by the investigator. In no text, however, were any topics discussed from the point of view of consumer education, as here defined.

As a second check, two of the judges who had evaluated the categories examined the principles and attitudes and the various categories which had been assigned to them. Upon completion of the examination both judges expressed the opinion that the assignment of the categories was in every case defensible.

An example of the assignment of knowledges of consumer education to a physical science principle is this:

The particular principle in this case was:
Each combustible substance has a kindling temperature which varies with its condition but may be greater or less than the kindling temperature of some other substance.

The knowledges of consumer education which might be used to develop this principle were:

Devices available for detecting fires in the home.

Comparison of procedures to be used with inflammable and non-inflammable cleaning fluids.

List of causes of fire in home and methods of preventing human injury and reducing property damage.

Meaning of the label of the *Underwriters' Laboratory*, which appears on some household goods.

An example of the assignment of consumer knowledges to a principle of biological science is as follows:

The particular principle is:

Enzymes, vitamins, and hormones are chemical regulators (stimulators and suppressors) of the reactions that occur in living organisms.

The knowledges of consumer education which might be used to develop this principle are:

Comparative vitamin content of food exposed to air or stored for lengthy periods, and fresh foods.

Values of the various vitamins and minerals in the diet.

Comparison of enriched, or fortified, foods with foods which have not been enriched or fortified.

Comparison of commercial vitamin and mineral products with natural food as sources of food nutrients.

An example of assignment of knowledges of consumer education to a scientific attitude is as follows:

The particular attitude is:

Habit of weighing evidence.

The assigned knowledges of consumer education are:

Methods of examining, and factors to be considered in reading labels accompanying food products.

Simple tests for detecting adulterants in foods.

Comparison of fresh, canned, and frozen food products with respect to cost, nutritional values, and methods of preparing and of cooking.

Comparison of quantities of food in various sizes of cans, glass jars and bottles, baskets and hampers.

Methods of checking for accurate weight and number when purchasing food products.

1. Seventy-three of the seventy-four categories which had received a positive value as explained in the preceding step were assigned to principles and/or attitudes.

2. Thirteen were assigned to 10 principles of physical science to the understanding of which they were judged to contribute; 45 were similarly assigned to 18 principles of biological science; and 15 to 3 scientific attitudes.

It seems reasonable therefore to assume that the knowledges of consumer education refined in this study may be used to contribute to the understanding of principles of science and to the development of scientific attitudes.

SCIENCE EDUCATION RESEARCH IN THE DIVISION OF SECONDARY EDUCATION OF THE UNITED STATES OFFICE OF EDUCATION

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In the establishment by Congress of the United States Office of Education in 1867, it was stated that this unit of the Federal Government was "for the purpose of collecting such statistics and facts as shall show the condition and progress of education in the several states and territories and of diffusing such information respecting the organization and management of schools and school systems and methods of teaching as shall aid the people of the United States in the establishment and maintenance of efficient school systems and otherwise promote the cause of education throughout the country." It is my responsibility to serve under these provisions and to devote myself especially to the activities that give promise of improving science instruction at the secondary school level. Research activities must be included as a part of my work program.

Staff members and graduate students at colleges and universities have carried on almost all of the science education research which has been done in this country. We must, however, recognize here the research

work done by leaders in science teaching while serving as supervisors or teachers in school systems and by educational leaders in state departments of public instruction. Furthermore, we should mention the science education research which has been done by a few leaders who have been associated with industrial and commercial organizations. The records of the United States Office of Education do not reveal much science education research as such, although many data about science teaching have been collected in studies of the broad aspects of secondary education.

The Office of Education has made its greatest contribution to the teaching of science by bringing together leaders in different fields and asking them to report the most promising results which their studies have revealed. Such reports have been published and distributed widely. The 1920 report on the *Reorganization of Science in Secondary Schools* is an example of this procedure. The Office has also initiated and directed national surveys of secondary education, such as the three-year

survey which resulted in a series of publications among which was the 1932 report on *Instruction in Science*. The Office has also aided those interested in science education research by publishing and distributing bulletins in which studies of different types were listed with a sentence or two of annotation. The *Bibliography on Science Teaching in Secondary Schools* of 1911 and 1925 are examples of this means of improving the teaching of science. The Office of Education has also gathered information on science and science teaching as a part of more comprehensive studies. The reports on *Offerings and Registrations in High School Subjects*, the more recent of which was for the years 1933-34, may serve as an example of one of these comprehensive studies. Plans have been made for another study of this type during 1949. Many other comprehensive studies have been directed by the Office, and in several of these studies, science has found its place along with other subjects of the secondary school curriculum. The dissemination of information has gone far beyond that which the research of the Office of Education would permit. This has been possible by virtue of the fact that the Office has availed itself of the research findings which have been brought to light by workers associated with colleges and universities and other non-federal agencies. It is my judgment that this service of disseminating information should be continued and expanded. It is also important that we participate more actively in the planning and conducting of research in those fields of science education which our office can more readily perform than any other agency.

In facing this question of what specific research in science education the United States Office of Education should carry on, I have been hoping that some plan could be developed which might provide the type of information science leaders desire, and at the same time, might help to open up additional research problems for others to undertake. Furthermore, I have been hoping that it might be possible for the Office

of Education to help in the coordination of all research activities which are being made related to science education. These hopes prompted me to recommend that an Advisory Committee on Research in Science Education be established to serve the Division of Secondary Education. When this proposal was approved by the Commissioner of Education, plans were made with Professor Earl R. Glenn, then President of the National Association for Research in Science Teaching, for nominations to be made by this association for service on this Advisory Committee. The following persons were selected from these nominations by the National Association for Research in Science Teaching: Mr. Arthur O. Baker of the Cleveland Public Schools, Professor G. P. Cahoon of Ohio State University, and Professor Francis D. Curtis of the University of Michigan. Professor Earl Glenn was invited to meet with the group at its June, 1947, meeting.

One question raised by this committee at its opening session was: Should we report on research in science education which the Office of Education alone should undertake, or, should we report on needed research in science education without much reference to who would undertake it? After some careful discussion, it was decided to report on the research in science education needed without much reference to who would undertake it. Their report consisted of 4½ single-spaced typewritten pages presenting fourteen problems. Several of these problems were divided into sub-problems. The major problems were as follows:

- I. Are science teachers now in service adequately qualified for their responsibilities in teaching junior and senior high school science?
- II. How can the science teachers of the nation find and identify with reasonable success talented boys and girls who may have an interest in studying science or engineering subjects in colleges of the nation?
- III. What can the United States Office of Education and other organizations do to improve the quality of: (1) the demonstration work done in General Science,

Biology, Chemistry, and Physics? (2) the laboratory work on an individual or group basis in the junior and senior high school science subjects?

IV. What important recommendations on the construction of science laboratories are needed for boards of education planning an extensive building program for the near future? What physical facilities may be considered as the minimum necessary for effective instruction in junior and senior high school science subjects?

V. What source materials are urgently needed for the various types of science courses?

VI. What are the important characteristics of good science teaching?

VII. What can be done to modify existing courses in Biology, Chemistry, and Physics to make them suitable for contemporary purposes?

VIII. Is it possible to develop a high school course in physical science which would be suitable for small high schools: (a) as a substitute for Chemistry and Physics, or (b) to serve as an introductory course to subsequent courses in chemistry or physics?

IX. To what extent is the subject matter of science now being utilized by teachers of the social studies, physical education, industrial arts, or possibly in the field of English in which the popular books of science are often used for supplementary reading?

X. To what extent are the increasing financial outlays for football, basketball, music, and general public functions absorbing school funds that are urgently needed either for the purchase of student apparatus in science or for the installation of necessary physical facilities such as demonstration and student tables and gas, water, and electricity services?

XI. What agency or organization could create suitable instruments for the evaluation of learning in the fields of science in: (a) elementary science grades 1 to 6, (b) junior high school science grades 7, 8, and 9, and (c) senior high school science such as Biology, Chemistry, and Physics?

XII. What are the present-day practices in the 48 states of the nation in granting certificates to teach science in the junior or senior high school grades?

XIII. What institution or agency in the United States could be persuaded to undertake the development of a whole series of new units for science instruction at junior and senior high school levels?

XIV. Some type of "sample Study" should be undertaken in the very near future to reveal the extent to which typical schools have all or only part of the students in a given year enrolled in a science course.

You might well ask what the Office of Education has done about these problems. It would be obvious to you that it would be impossible to initiate each of these studies even if it were judged proper and desirable to do so. In reporting on the progress which has been made, I would like to project my own judgments concerning how these problems might be attacked and studied. I am doing this because I would like your counsel in developing policies which would form the basis for wide-spread cooperation and coordination of research in our area of specialization.

It is my judgment that science teaching can be improved with greatest certainty of affecting classroom practices in a desirable manner if a large number of individuals who are directly concerned with these problems be stimulated and helped to undertake and carry forward the studies which are of direct concern to them. Consequently, I have attempted to follow the policy of co-operating with individuals and associations who are vitally concerned with problems of science teaching rather than undertaking many research problems as a specific activity of the Office of Education. The practical result of this policy will be noted in the reports which follow concerning what has been done on the problems presented by the Advisory Committee.

Problem I, dealing with the qualifications of teachers, was judged to be one in which state organizations of science teachers should have large responsibility. It has been possible to enlist the cooperation of the New York State Science Teachers Association, The New York City Federation of Science Clubs, and the National Science Teachers Association in a study of science teachers and science teaching in New York state. It was possible to negotiate a grant of money from the General Electric Company at Schenectady to provide for the expenses of the committee members responsible for this study. It is my hope that the Office of Education may participate in the dissemination of the important findings of this study and to stimu-

late and assist other groups of science teachers in other states and territories to undertake similar investigations.

Problem II, related to the finding and nurturing of students of high abilities and scientific purposes. It was felt that Science Service and Science Clubs of America had already initiated and promoted a very constructive approach to this problem. Consequently, the Office of Education stands ready to assist them rather than to launch a competitive study and related service.

Problem III, related to improving the nature of demonstration and laboratory work, I can report that we have done considerable thinking and we have decided to explore the values of service leaflets which would be distributed by the Division of Secondary Education. Several such leaflets related to science teaching are in the planning stages and the judgments of numerous persons in the Office of Education will determine what results we will obtain. Some of the first service leaflets are likely to be of a rather general character but others are expected to follow which will deal more specifically with the more critical problems of science teaching. However, it is unlikely that we will issue service leaflets which will be so specific as to be directly usable in the classroom. The reasons for this will be mentioned in connection with one of the other problems.

Problem IV, concerned with recommendations on the construction of facilities for science teaching has been touched by our distribution of information and references relating to specific requests which have come to us. We have not launched any research studies in this area. It is our understanding that several studies are under way, and it is our hope that we may brief such investigations and disseminate the pertinent findings as a service leaflet to all those who seek such information.

Problem V is concerned with the need for source materials which would help to improve classroom teaching in the sciences. It is my judgment that this problem should be studied and the source

materials prepared and distributed by our voluntary professional organizations. The Office of Education opens itself up to the charge of federal control of education, when our service moves close to the classroom work of the teachers. There are many people who feel that suggestions coming from a federal office represent needs of a high degree of priority. Consequently, many persons are prone to take such matters as directives rather than as suggestions. We believe wholeheartedly that it is the function of the local school units to determine the school program and we do not wish to do anything which might be interpreted as interfering with the local control of education. This is the reason why we are concentrating on comprehensive studies and general types of service, and why we are avoiding the preparation and distribution of resource units. We believe that there are many forms of source materials which will help the teachers to improve their work but which gives them full freedom and responsibility for determining what is to be selected and used. It is our desire to be helpful in all ways which will preserve the individual initiative and responsibility of the classroom teachers of the nation. This need for source materials has, however, not been neglected. We have worked with the National Association of Secondary School Principals, The Atomic Energy Commission, and several other professional groups in developing a project concerned with atomic energy. We have worked with the National Science Teachers Association and the National Association of Secondary School Principals in attempts to secure foundation support for a series of resource units related to the sciences. We intend to continue efforts toward helping professional groups to meet this need for resource materials. The same general policy as has been here discussed relates to Problem VII dealing with the modifications of science courses of study, Problem VIII dealing with a high school course in physical science, Problem XI dealing with instruments for the evaluation of learning, and Problem XIII concerned with the develop-

ment of a whole series of new units for science instruction.

This leaves Problem VI concerned with the characteristics of good science teaching, Problem IX dealing with the use of science subject matter by non-science teachers, Problem X involving the possible diverting of funds from science by other school activities, Problem XII on certification practices, and Problem XIV concerned with enrollment by classes in the sciences.

Concerning Problem VI, dealing with the characteristics of good science teaching, we are beginning work on a bulletin which has been given the tentative title of *Scientific Methods in Everyday Use*. Our plan is to put this into mimeographed form for discussion use and constructive criticisms. We hope to make use of all suggestions received, and about a year later release a revised bulletin in printed form. Work has just begun on the preliminary bulletin and copies are not likely to be available until in the fall. Concerning Problem IX on the use of science subject matter by non-science workers, the Office of Education is involved in a comprehensive project called *Life Adjustment Education for Youth*. It is anticipated that there will be much sharing of information between different groups of teachers as a part of this project. Concerning Problem XII, on certification procedures, we are interested in working with the Cooperative Committee in Science Teaching of the American Association for the Advancement of Science which has undertaken some studies in this area. We hope that our Office may assist this committee as it continues work on this general problem.

Problem XIV, on enrollment by grades in science studies, has been undertaken as a specific research study of the Division of Secondary Education. It is planned to include General Science, Biology, Chemistry, and Physics, and seek data regarding enrollments by sex and grade levels, time for class and laboratory work, grade levels enrolled in Biology, Chemistry, and Physics classes together with an indication of new topics, or problems which relate to these

subjects. It is our plan to launch this study this spring and we hope to have a report ready in the fall.

I would now like to project this question of science education research into the future. I wish to pursue the hope that a constructive plan may be developed which will embrace the members of the National Association for Research and Science Teaching and all other persons interested in studying the problems of science teaching. There is so much science education research that needs to be done that we should develop a plan which will make the best use of the resources available to us. One of our major needs is to be kept currently informed concerning research studies which have recently been completed and research studies which are now in progress. I feel a very great need for this information, and I am sure that many of you share this feeling with me. I would be willing to give a great deal of time to assisting the National Association for Research in Science Teaching in collecting such information and making it available to all who may make good use of such information. As a federal agency which has no graduate students to consider, and no special science education program to promote, perhaps we would be in a strategic position to collect information about research completed and research in progress. I believe it would be possible to develop a plan whereby such information could, from time to time, be referred to one or more committees of the National Association for Research in Science Teaching for study and evaluation. The Office of Education could then function according to its charter by disseminating reports on research in science education which is judged to be of importance and dependability.

With an Advisory Committee on Science Education Research already established, the National Association for Research in Science Teaching may desire to consider a plan for some rotation of membership on this committee. Perhaps a three-year period of service with the terms of service so arranged that one member would be

replaced each year, may be a desirable plan. Perhaps the membership of this Advisory Committee should be expanded to include persons representing science teaching at elementary school level as well as science teaching at college levels. Perhaps the plan should involve methods whereby each member of the National Association for Research in Science Teaching may help to alert members of this Advisory Committee to problems which are urgent and important. Perhaps the plan may include means whereby the problems which are judged important by the Advisory Committee may be given wide dissemination in order that staff members and graduate students may come to understand these problems, and perhaps elect to carry on studies related to them. Perhaps the plan may even involve

some scheme whereby staff members and graduate students may come to cooperate with others who are pursuing similar problems and whereby each of us may become informed of persons and places where certain problems are being studied.

It seems to me that there are many phases to this general problem of becoming informed of science education research, of being alerted to problems of special urgency, and planning together a comprehensive program of science education research which may guide us to the solution of some of our vexing problems. In all such endeavors, I wish to participate in whatever way gives promise of improving the teaching of science in the secondary schools of the nation.

PROGRAM REPORT OF THE COMMITTEE ON RESEARCH IN ELEMENTARY SCIENCE FOR THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING *

THIS committee decided to confine its efforts to gathering data relative to the following four problems: (1) What research problems are important for study in the field of elementary science? (2) What are the important courses of study in elementary science completed since 1940? (3) What significant current research has been done in teachers colleges and universities during the last ten years? (4) What new curriculum practices are being developed in the field of elementary science?

After considerable correspondence it was decided that the committee would further delimit its activities to the first two problems indicated.

With reference to its research the committee suggests need for study in the field of science in the elementary school to determine:

The extent of academic preservice preparation now received by teachers.

* Report made by the Chairman of the Committee, Glenn O. Blough.

The extent and kind of in-service training now in use.

The age levels at which science concepts, principles, and skills may be introduced with optimum effectiveness.

Types of equipment needed in rooms for teaching elementary science.

Provisions made in various school systems for including elementary science in the curriculum.

Most effective methods for using visual aids in the elementary school curriculum.

Means being utilized to integrate science with other school subjects.

Effective methods for using community resources in elementary science instruction.

What influence recent findings in child growth and development should have on the elementary science curriculum and methods of instruction.

What types of evaluation instruments are most effective and how they should be used.

Effective methods of evaluating text book material and other types of learning aids.

Various techniques for helping teachers

in service develop adequate science experiences with boys and girls in the elementary school.

Effective methods for using science materials and activities as a source in developing reflective thinking.

Opportunities and demands for science experiences in the integrated program of the elementary school.

With reference to problem No. 2, courses of study in elementary science, the work of the committee to date is incomplete. Each of the committee members was apportioned three states in which to conduct rather extensive correspondence to determine what courses of study have been prepared. At present these lists are incomplete, and if the work of this committee should be continued further work will be done to make a more comprehensive list of courses of study.

A quotation from a letter of one of the committee members with reference to courses of study is included here for its significant statement. "Thus far, I have not come upon much except a few routinized outlines. As I have visited class after class in these places I have been forcibly struck with how little genuine problem solving, making use of planning, experimenting, using wide variety of material, actually does go on in the average school. At any number of places teachers, super-

visors, and administrators expressed a concern for doing something about the lack of science experience but they really don't know where to turn for help. Their own local science teachers in the junior and senior high schools are not creative or understanding in helping to develop a program of adequate science experiences for elementary school boys and girls. Many of the teachers take science courses in college and universities as a part of their summer school work but principals tell me that not much happens as a result in the way of introducing more science experiences with the boys and girls."

As yet nothing has been done on problems 3 and 4.

This rather brief report of the committee should not be construed to mean that there is not a great deal of work to be done by this committee. Research of the type undertaken by this committee, which must of necessity be carried on by correspondence is bound to be very slow since all of the members of the committee are involved in full time work.

Respectfully submitted,

ANNA E. BURGESS

ROSE LAMMEL

BETTY LOCKWOOD

JEROME METZNER

JOE YOUNG WEST

GLENN O. BLOUGH, *Chairman*

NEEDED RESEARCH STUDIES IN JUNIOR HIGH SCHOOL SCIENCE TEACHING *

PRELIMINARY REPORT OF JUNIOR-HIGH-SCIENCE COMMITTEE

INTRODUCTION

AT the 1947 meeting of the National Association for Research in Science Teaching, the President recommended that the organization establish several basic committees to review the present status of investigations in the various fields of science education and make recommendations to the association on areas of research that

might well be encouraged as a matter of long-time planning for the activities of the organization.

The functions of these basic committees might be such as the following:

1. To review the papers presented at the 1947 meeting in Atlantic City and take from them any suggestions for investigations that might be considered appropriate for the committee members to examine.
2. To suggest additional studies needed

* Report made by the Chairman of the Committee, Earl R. Glenn.

that grow out of the educational difficulties of local communities or from personal experiences of members of the association.

3. From all the suggestions compiled, it was considered important that the committee isolate, if possible, certain areas for research which are more or less urgent in character and which need attention at an early date.

4. An additional responsibility relates to the matter of giving attention to investigations of an extremely complex character which probably require teams of research workers for any effective attack on such problems.

5. It was suggested that the committee make a survey of the graduate schools of education and the colleges for training teachers to discover where, if possible, researches in various fields of science education might be initiated.

6. In connection with the survey of the graduate schools of the nation, it was further suggested that correspondence be carried on with university schools, laboratory or demonstration schools to discover whether certain centers could be established where long-time plans for research in science education could be carried out.

During the past year, the junior-high-school-science committee has carried on such activities as the following:

1. Proposed investigations have been assembled as shown in the pages that follow.

2. A survey has been made of unpublished theses and dissertations and this list, by no means complete, is to be found on the following pages.

3. Extensive discussion has been devoted to areas most in need of investigation in this field of general science.

4. We have considered a proposal to make a survey of all published investigations that can be found in print since the year 1925.

5. We have proposed to Dr. Philip G. Johnson, specialist in science, U. S. Office of Education, that he and his associates

cooperate with a committee from the National Association for Research in Science Teaching in publishing a bibliography of unpublished theses and dissertations from 1925 through to the present, and that a bibliography be published covering all magazine articles and special publications now in print of an investigational character having to do with junior-high-school science and possibly the other high school science fields in addition.

This preliminary report must be considered as just a starting point. We hope the members of the association will write the chairman of the committee suggesting activities that need attention. Furthermore, we hope that readers of *SCIENCE EDUCATION* will send suggestions on any matters that need to be considered in the preparation of the report for the annual meeting in 1949. The chairman wishes to acknowledge the very important contribution to the work of the committee by the bibliographical specialists of the U. S. Office of Education. The titles in the bibliography have been assembled from the publications entitled "Research Studies in Education," 1928-1940, as published from time to time by the Library Division of the U. S. Office of Education.

SECTION I. Proposals by Victor H. Noll, Michigan State College.

The following are areas rather than specific studies. Each one would probably constitute a field calling for a number of investigations. Each one seems to me an important and potentially fruitful direction for research:

1. What are the needs in science for pupils of junior high school age? We have had analyses of magazines, newspapers, and the like. There have been some studies of adult activities. But we really have not come to grips with the problem of what science boys and girls need to know in order to live fuller and more effective lives as boys and girls and as future citizens. I do not believe that "needs" provide a com-

plete basis for curriculum development, but they do constitute an important approach.

2. How can general science be organized and presented so that it will be appropriate for the levels of abilities—the range as well as the average—of boys and girls in the junior high school? We have had a number of studies showing that the vocabulary of our textbooks is too difficult, that the science concepts presented are often too advanced for children at this level, and that they cannot read with understanding and profit, much that is found in the general science textbook. We need studies positively oriented in the direction of determining what is appropriate to their ability levels.

3. What is a desirable sequence and time allotment for general science in junior high school grades? All possible variations and combinations are practiced but we have little or no evidence to support any of them. We have general science one, two and/or three years; five, four, three, two, or one times a week; we have it in seventh, eighth and/or ninth grades. A sequence based on evidence that science teachers could wholeheartedly support would be most helpful in convincing school administrators and parents of the value of our subject.

4. What elements of the scientific method and what scientific attitudes can be taught so as to function in the lives of junior high school pupils? Admitted that they have limitations, can we determine what elements of these important goals they can understand and use? Much of our emphasis on scientific thinking is just "between us teachers" and our pupils may not even hear it, let alone understand it. When we do stress these things, I feel that our pupils often do not even understand what we are driving at.

5. What are some principles basic to the effective use of multi-sensory aids in teaching junior high school science? There is an immense area here for investigation. A great deal of money is being spent in the development and distribution of such aids

but we know little of their real value in teaching science or of how to attain the maximum value through their use. Evidence is comparatively meager, much of it is not scientific, and some is conflicting.

As stated above these are areas of investigation rather than specific problems. Each one could be broken down into many specific problems suitable for investigation. I believe the committee should attempt an analysis of one area. This should be followed by a careful survey of the literature to see what evidence is available already. Then we should be in a position to suggest needed research studies to begin filling in the gaps. It's a long hard row but I don't see how we can make much progress in any other way.

SECTION II. Proposals by Alfred D. Beck, Assistant Science Supervisor, Division of Junior High Schools, New York, N. Y.

1. An investigation into the kind of science teaching (approach and content) that will be most effective in meeting the needs of pupils in a large metropolis. This assumes a parallel investigation into the nature of the needs of these pupils. Separate provision it seems would be necessary for the needs of youngsters *per se* and for the needs we anticipate that they will have when they become adults. A study of this kind would also have to recognize the special needs of slow learners and of gifted pupils.

2. An investigation seems to be needed into what are the best methods by which the effectiveness of a science program may be evaluated. An attempt should be made to measure the "intangibles."

3. An investigation is needed to determine the best ways in which the concepts and methods of science can be integrated with other subject areas.

4. The recommendations of teachers should be obtained with respect to the redesign of science classrooms. Most teachers modify the design of their rooms and incorporate their own gadgets but they

seldom have a chance to become articulate regarding the basic design, size, or location of the room. I know of no recent study of this kind.

5. The effectiveness of science supervision should be evaluated. A study should be made of the techniques of this supervision and what remedial measures are suggested and what follow-up is done. It is important to know how supervisors become qualified to supervise science teaching at the elementary and junior high school levels.

6. There should be a study made of the kind of in-service training that is desirable for teachers who:

- a. Were licensed to teach science within the past 5 years.
- b. Were licensed to teach science more than 5 years ago.
- c. Are teaching science without license.

7. A study should be made to discover how many people are teaching science without license and why.

8. There should be a nation-wide survey of specific teaching techniques. These could be catalogued and published in a looseleaf format that could be brought up-to-date or supplemented as new ideas become available. This would serve as a kind of handbook or super-teachers-manual.

9. Someone should determine the extent to which adult education in general science concepts (including recent developments in science) is needed and if the situation warrants it, a program for this type of education should be prepared and urged upon those whose duty it is to provide adequate instruction for adults. I suspect a great deal of scientific illiteracy exists at this level.

SECTION III. Proposals by George G. Mallinson, Iowa State Teachers College, Cedar Falls, Iowa.

There are several issues in the field of Junior-high-school science which, in my opinion, are worthy of investigation. They are as follows:

1. In the majority of schools with which

I am acquainted, the junior-high-school science teacher has the eighth grade general science on Monday, Wednesday and Friday and the seventh grade general science on Tuesday and Thursday. The students at both these levels have either Industrial Arts or Home Economics in the vacant periods. Many schools are now teaching general science seven and eight every day for one semester, the other semester being devoted every day to Home Economics and Industrial Arts.

I deem worthy of investigation this question, "Is learning in seventh and eighth year general science improved by holding classes on alternate days for the year, rather than by holding classes five days per week for one semester each year?"

2. Since individual-laboratory work is practically non-existent at the junior-high-school level in science the following might further be worthy of investigation: "To what extent may learning in junior-high-school science be enhanced by providing individual laboratory experiences?"

3. Since teaching children to use the elements of the scientific method is generally considered to be an important objective of all science teaching the following seems worthy of investigation: "What particular elements of the scientific method may junior-high-school students be taught to use, and what means are best adapted to teach these elements, through junior-high-school science courses?"

4. The counterpart of No. 3 also seems worthy of investigation: "What are the best ways of inculcating scientific attitudes in junior-high-school students, through the scientific courses?"

5. The following also seems to be worthy of investigation: "To what extent is pupil planning feasible in determining content and procedure for junior-high-school science courses?"

SECTION IV. Proposals by Paul F. Brandwein, Forest Hills High School.

I have thoroughly examined the October, 1947, issue of *SCIENCE EDUCATION* as you

suggested. I have also given particular thought to the type of investigation which will be useful in the junior high school field.

It appears to me that much would be gained if we were to concentrate on a few selected areas rather than spread our energies over many problems. I am suggesting these for further study by the committee:

1. We need first, it seems to me, a complete study of what has been done and what is being done in this area. It would seem desirable for our committee to go about preparing a complete summary (monograph or yearbook, if you will) of the work already done and work in progress. The other committees might do the same.

2. At the same time, we need, it is clear, a setting forth of standards for research and investigation. (This need is apparent from the reports of research now extant. A meeting of a commission of the N.A.R.S.T. to set standards and define terms is desirable. Meetings of chemists and biologists served the tremendously important purposes of defining nomenclature.)

3. The following specific areas of research and investigation are suggested:

A. Under what conditions do junior high-school teachers work? (Physical conditions of work day, etc.)

B. What revisions of the junior-high-school science curriculum are desirable in view of recent world developments? (Science per se, and science in the core curriculum.)

C. What revisions of the methods of preparing teachers for teaching junior-high-school science are necessary and desirable?

D. What methods are available for selecting "science talented" students on the junior-high-school level?

E. What is the best structure of a given lesson (classroom and laboratory) for the age level in the junior high school?

F. What is the best organization of classroom and laboratory furniture for

the students of the junior-high-school age level?

G. What methods of selection will give us the most competent teachers for the junior high school science?

These are some of the areas which I feel we ought to concentrate on first.

4. With regard to my own investigations, I am completing—

A. A report of an investigation on teaching conditions in New York State (as chairman of a committee of the N.S.T.A., under grant from G.E.).

B. An investigation of the background of science talented students.

C. An investigation of an organization of a four-year science curriculum (the course is now in its third year at Forest Hills).

SECTION V. Proposals by John Verrill, State Teachers College, Bemidji, Minnesota.

You also asked me to set down some ideas on investigations which might be promoted in this field. I hope the following are not too general; I am sure you probably have heard them before, but they are the problems I'd like to know more about.

1. Better means of evaluation as to good standardized tests on the junior-high-school level.

2. Studies to see if the laboratory can be made a more definite part of junior-high-school education as well as improvement in what present laboratory techniques are used.

3. Studies on pupil readiness for the more advanced science concepts. It seems to me this is going to be important because with the great increase of scientific knowledge we are soon going to have to teach scientific concepts in the junior-high-school previously reserved for senior high school science courses.

4. Studies to show if any preference should be shown in the subjects chosen to be taught in junior-high-school; by this I

mean among the three subject fields of biology, chemistry, or physics.

5. I think the textbook situation on seventh and eighth grade level is in a rather sorry state. Probably something will be done about this now that the war is over and many more texts will be appearing. I have always felt that all the seventh and eighth grade texts that I have examined were simply cut down versions of ninth grade texts. I do not begin to think they exhaust the tremendous possibilities that exist in this field; for instance, how many of these texts even mention such a thing as the scientific method?

SECTION VI. Proposals by Donald S. Dean, Baldwin Wallace College, Berea, Ohio.

1. What is the place to be occupied by the junior high school science course? How can the junior high science curriculum be coordinated with that of the elementary school and the high school so that the junior high is not left with the job of going over material from which the cream has been skimmed in the elementary school or giving a watered-down version of what many of the students will study in senior high?

2. Can the feverish, scattered pace in junior-high-science be slowed down and be made more thorough? This might be accomplished by increasing the length of the required course. It might be accomplished by setting up a definite area to be covered at this level and abandoning the idea of covering the whole field of science in a few semesters. As I see it, this has a definite relation to my first point.

3. Can a textbook be written which will fit the course of study taught? I appreciate the problem involved. Of course, the book will sell in more school systems if somewhere in the book is treated each subject that any school system might want to offer. This treatment, however, just reduces the course to a review of elementary work and a vocabulary-ridden sketch of high school work.

SECTION VII. Proposals by James A. Keech, State Teachers College, Castleton, Vermont.

At the suggestion of the chairman of the committee Mr. Keech has been working on the following problems:

1. What colleges in the New England states offer adequate undergraduate training for prospective general science teachers?

2. In what college could a general science teacher do graduate work in science and science education and write a thesis on some investigation in the field? Part of the manuscript that Mr. Keech has prepared follows. This section deals with problem two above.

A survey of science and science courses of the colleges and universities of the states of Maine, Massachusetts, New Hampshire, Rhode Island and Vermont to find out which ones grant graduate degrees either in education, elementary or secondary, or a degree made up of courses from a department of biology or chemistry and certain courses from the department or school of education. It is felt that it would be very valuable to know at this time in what colleges a student can work out a master's degree in general science, let us say, and, at the same time take courses in secondary education, educational measurements, teaching of general science, and prepare to do a thesis.

In order to answer the implied questions in the above statements, letters were sent to the commissioners of education in each of the above mentioned states asking for a complete list of colleges and universities doing work above the high school level. Replies from the commissioners indicated that there were 101 such institutions. Letters were then sent to the registrars of all but 17 colleges in Massachusetts, the state normal schools in the state of Maine, and the three state teachers colleges in the state of Vermont, asking for catalogues describing work done on a graduate level in science and science education. Replies were received from all but the Boston School

Committee, Teachers College of the City of Boston; College of St. Joseph, Framingham; Curry College, Boston; International Y.M.C.A. College, Springfield; Jackson College, Medford; Portia College of Liberal Arts, Boston; and St. Regis College, Weston.

Seventy-one usable replies were received. Of these, 24 indicated that they did work in science on the graduate level. Of the 24, the following 14 colleges indicated through their catalogues or in response to a personal letter to the dean of the graduate school, that work in science and science education could be carried on for a master's thesis, or a doctorate on the high school or elementary school level. The catalogues in no cases indicate direct answers to the implied questions above. Answers are inferred by the writer except where verified by direct correspondence with the deans of the graduate schools. In the cases of the schools not mentioned below, it could *not* be inferred by reading the catalogues that work of the nature described could be done.

THE FOURTEEN COLLEGES

1. University of Maine, Orono, Maine. The catalogue indicates that it might be possible to work out a master's thesis in science problems on the senior high school level. (No reply to letter to dean of Graduate school.)

2. Boston College, Chestnut Hill 67, Mass. Students who are working on theses in pure science fields "could not do their work in education on the thesis." A problem such as that suggested by Wickware, "would be worked on by students who were majoring in education." The above information was obtained by letter from George A. O'Donnell, S.J., Dean of the Graduate School.

3. Boston University, Boston, Mass. In correspondence, Dean Chester M. Alter, of the Graduate School, states "Boston University has many graduate students working on problems in the teaching of science in the secondary schools."

4. Clark University, Worcester, Mass.

Master of Education degree is offered for work on the high school level, only. A letter from the dean of the graduate school indicates that a problem such as stated by Wickware could be worked out on the secondary level.

5. Harvard University, Cambridge, Mass. According to a statement in the catalogue the program of work on the graduate level is very flexible. Master's degrees and the doctorate are granted for work done in the fields of teaching science in the secondary and elementary schools. The writer infers that graduate degrees would be granted for work done in the teaching of science in the junior high school, although the junior high school is not mentioned in connection with the teaching of science in the catalogue.

6. Mount Holyoke, South Hadley, Mass. In the graduate school a course entitled "401-402. Independent study. In these courses students may pursue individual projects, generally in related areas of academic and professional fields."

7. Northeastern University, Boston, Mass. A four-hour course in methods of teaching in secondary schools is offered on the graduate level. There is no indication that anything is offered in the teaching of science in any school.

8. Radcliffe College, Cambridge, Mass. According to the catalogue of the graduate school, the choice of fields (in education) includes elementary education, and secondary education and the curriculum and methods in a specified school subject. The doctor of philosophy degree is the only advanced degree offered in education.

9. Tufts College, Medford, Mass. The graduate catalogue indicates that research in education in *any* field may be pursued toward a graduate degree. Letter from Dean John P. Tilton states that Wickware's problem could be used to secure a master's degree. It could be done on any grade level of the public school.

10. University of Massachusetts, Amherst, Mass. According to a letter from

F. J. Scivers, the Wickware problem could be used to secure a master's degree only for those students who choose to major in Education. This work could be done on the senior and junior high school and elementary school levels.

11. Wellesley College, Wellesley, Mass. A student in the graduate school could elect problems in the teaching of science in secondary and elementary schools to receive the degree of Master of Arts in Education.

12. University of New Hampshire, Durham, N. H. Courses are offered in the graduate school in Principles and Problems of Teaching in the Secondary School, Junior High School Evaluation, Workshop in Secondary School Curriculum Development, and Research Problems in Secondary Education.

13. Brown University, Providence, R. I. Brown University offers the Master's and Ph.D. degrees for work done in education on the senior and junior high school levels. No mention is made of science in connection with education.

14. University of Vermont, Burlington, Vt. In a personal conference with Dean Bennett C. Douglas of the School of Education, he indicated that he would be happy to entertain any students who wished to do graduate work in science teaching on the high school, junior high school and elementary school levels.

* * * * *

In all of the schools mentioned above science work on the graduate level is being carried on.

I am sure that interviews with those in charge of schools of education in the above mentioned institutions and many of those not included above would elicit information which might alter the above list.

* * * * *

The following colleges and universities offer educational work in graduate schools on the high school level only: University of Maine, Boston University, Clark University, Mount Holyoke College, and Northeastern University.

The following colleges and universities offer work in education in graduate schools on the high school and junior high school levels, only: University of New Hampshire and Brown University.

The following colleges and universities offer work in education in graduate schools on the high school and elementary school levels only: Radcliffe College and Wellesley College.

The following colleges and universities offer work in education in graduate schools on the high school, junior high school, and elementary school levels: Harvard University, Tufts College, University of Massachusetts, and the University of Vermont.

SECTION VIII. Proposals by Mrs. Gjertrud Smith, Los Angeles City Board of Education, Junior High Education Division, 451 North Hill Street, Los Angeles 12, California.

I. Our greatest concern right now is with the education and preparation of science teachers. In January, the three science supervisors of the Los Angeles City Schools met with representatives of the University of California at Los Angeles on this problem. Our University colleagues were very much interested in our suggestions and have agreed that it is not so much a matter of choice in *units* in certain fields, but rather a revision of subject content offered in already required courses. We also have the problem of a five year training program rather than the four years required by most states.

Notes from Meeting for Discussion of the Preparation of Science Teachers—January 19, 1948—U.C.L.A.:

1. Many science teachers tend to teach courses which emphasize the minutia of subject matter rather than the broad implications and generalizations of science phenomena and invention. We believe this is partly due to their highly specialized training, which developed habits of thinking common to research scientists rather than to science educators. We feel that all teachers should be educators *first* and science minded *second*.
2. Many science teachers fail to relate science information to the problems of living common

to all children. Their science fails to be *functional*.

3. Many science teachers are not versatile because their highly specialized training limits their teaching area.
4. Many science teachers lack the ingenuity necessary to motivate and to stimulate interest in science.
5. Many science teachers lack the ability or the understanding of the importance of carefully laying the foundations for the development of scientific thinking, skills, and attitudes.
6. Many science teachers tend to use the lecture and teacher dominated method of instruction. They are not trained in progressive teaching techniques.
7. Many science teachers lack an understanding of the fundamental laws of learning or do not have the techniques necessary to apply them in classroom situations.
8. Training is not given to prospective science teachers in the developing of simple laboratory experiments and demonstrations suitable for secondary school science classes.

Summary: After considerable discussion the following suggestions were made by members of the group:

1. The present requirement of six units of science in the graduate year might be modified to more nearly meet the needs of science teachers.
2. Some provision should be made to improve the science minor, especially in general science.
3. The teaching profession should be given equal status and recognition with that of professional work in science, such as research and industry. This responsibility lies with the University Counsellors and the individual professors. It was pointed out that teaching positions now pay as much as industry.
4. There seemed to be general agreement that there needs to be a study made of the *content* of science courses for prospective science teachers.

II. A problem which seems critical to us is the matter of getting suitable science textbook materials for use with slow-learning pupils. Except for some very excellent booklets, we can find no texts and few library materials for teachers to use in junior and senior high schools with pupils who have limited reading ability. We find that most science texts written for junior high schools have a reading level of about eleventh grade. Those few science texts which have a fourth or fifth grade reading level are also endowed with pictures showing fourth and fifth grade children. This, our junior and senior high sophisticates

will not tolerate! Perhaps some bright-brain may be subsidized while writing these needed materials. I understand from publishers that no one will do it because the market is so uncertain. I'm sure that such books, if well done, would have great sale.

III. An investigation should be made to determine how science concepts are developed (through what present accidents of teacher technique, etc.). All of us are sure that the development of certain basic concepts in science are most important in the junior high school. None of us is sure how these concepts actually are developed. Also, it would be an excellent idea to study what, exactly, *are* the basic concepts which we want youngsters to achieve.

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X. Mathematics in General Science

Agnew, Letha Alice; Bock, Lillian A.; Wallace, L. Dean.

XI. Laboratory and Demonstration Equipment

Heacock, Elmer V.; Propst, Otis H.; Richardson, Evan Carleton.

XII. Surveys of Superstitions

Jordan, Albert Tate; Smith, Victor C.; Vicklund, O. W.

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PROGRESS REPORT OF THE COMMITTEE ON RESEARCH IN SECONDARY SCHOOL SCIENCE *

THE Committee on Research in Secondary School Science was organized after the annual meeting of the National Association for Research in Science Teaching held in Atlantic City, March 2-4, 1947. The committee consists of twelve members, who hold positions of educational leadership in Colorado, Illinois, Oregon, Missouri, Indiana, Texas, Ohio, and New York. Some members are in positions which give them contact with schools throughout the United States. With the exception of one meeting held in Atlantic City on February 22, all committee work has been carried on by correspondence.

According to instructions received from the Executive Committee of the N.A.R.S.T., the committee on Research in Secondary School Science was to:

1. Consider suggestions of problems in secondary school science that were reported in various papers presented at the N.A.R.S.T. Spring Meeting, 1947;
2. Decide which of these problems were most worthy of study; and
3. Seek individuals or groups of individuals to carry on the investigations.

Since only a few of the members of the committee had attended the 1947 N.A.R.S.T. meeting, it was necessary to acquaint all members with the nature of problems presented at that meeting. This was done by analyzing each of the reports that had been presented and preparing a list of these problems dealing with secondary school science. A list of 26 problems was mailed to members of the committee in

July, 1947. Each member was asked to do several things. First, after reading the list of problems, he was to add any new problems which he considered as important as any already on the list. Next, he was to go over the revised list of problems and select two problems upon which he believed the Secondary Science Committee should concentrate its attention. Finally, he was to write his reasons for selecting the two problems.

By the middle of August sufficient replies had been received to continue with the next step. The replies from each member were analyzed and his selection of problems tabulated. There were fourteen problems selected by one or more members as being important for investigation. The numeral in parentheses after each of the following problems indicates the number of members who selected that problem:

1. How can problem-solving be taught most effectively in high school science courses? (4)
2. How effective have programs for inservice education been in improving science instruction? (3)
3. How can problem-solving outcomes be evaluated? (3)
4. How can problems that are potentially significant for study in science classes be identified? (2)
5. How can more functional types of laboratory experiments be developed? (2)
6. What changes do we wish to take place in high school students as a result of their experience in science? (2)
7. What can be done to improve the readability of textual materials in science? (1)
8. What are the conditions that account for the failure of science teachers to improve their programs of instruction? (1)
9. What should be done for the student with special interest and ability in science? (1)

* Report made by the Chairman of the Committee, J. Darrell Barnard.

10. How can the outcomes of science instruction be measured effectively? (1)
11. What are the particular areas and points of conflict encountered in living in our technological age that a study of science can help relieve? (1)
12. How can audio-visual aids be used more effectively? (1)
13. What should be the relation of senior high school science to science taught in the junior high school? (1)
14. How can the teacher education institutions perform their task in such a way that teaching will be presently and definitely changed for the better? (1)

Although only nine members submitted their selections of problems, there was a total of 24 selections made. This was accounted for by the fact that several members selected more than two problems.

It will be noted that three of the fourteen problems listed above deal with some aspect of teaching problem-solving. Out of 24 selections distributed among fourteen problems, ten selections were recorded for the three problems dealing with problem-solving. Reasons which members of the committee gave for selecting problems dealing with problem-solving included the following:

"... It is the one significant aspect of science learning that we know the least about and do the least about."

"For many years teachers and textbook authors have talked about teaching problem-solving and the scientific method, and research workers have identified steps in problem-solving and aspects of scientific method. Yet we have very little reason to believe that the students come out of our science classes any better able to solve their own problems than before they entered."

"Learning is dependent upon it."

Results of the analysis of committee members' selections of problems were then sent to each member. Since problems dealing with problem-solving were indicated most frequently as being important, "problem-solving as it should be dealt with in the secondary school" was selected as the problem area upon which this committee should concentrate its attention.

Committee members were then asked to suggest the more specific problems which they felt the committee should consider in its next step, that of developing plans for

getting people in various sections of the country working upon problem-solving in science teaching. The following seven questions were formulated from suggestions sent in by committee members:

1. Why do we consider ability in problem solving to be a desirable outcome of science teaching at the secondary level?
2. Of what does ability in problem-solving consist?
3. Can ability in problem solving be taught?
4. What learning activities can be used to develop ability in problem-solving?
5. What classroom situations are most conducive to problem-solving activities?
6. How can ability in problem-solving be measured?
7. How can the accepted techniques for problem-solving be introduced into more secondary-school teaching situations?

It was the consensus of the committee that it needed some clearly formulated and appropriately documented statements regarding the significance and nature of problem-solving in science teaching. It was decided that the first three questions in the preceding paragraph should be used as bases for formulating statements regarding the significance and nature of problem-solving. It was further agreed that the completed statements should be published in pamphlet form and made available to all who would subsequently become involved in the various projects to be developed by the committee.

The last four questions listed above are to be used as guides in identifying the specific problems that should be investigated. Within the near future each member of N.A.R.S.T. will be asked to suggest specific problems which need to be investigated under each of the last four questions listed above. The suggested problems, obtained in this manner, will be organized into a report and made available to interested persons.

The committee is concerned with doing more than merely encouraging the formal investigation of specific problems in the area of problem-solving in science education. It is also concerned about getting more classroom teachers to explore techniques of introducing problem-solving into

their teaching. This latter concern is based upon the assumption that we already know something about teaching problem-solving even though there are still many unanswered questions. Furthermore, the classroom teacher will be the one who ultimately determines whether anything is done with problem-solving in science classes. It is therefore important that this committee should give immediate consideration to the classroom teacher in whatever plans of action the committee may develop.

Four plans of action have been agreed upon by the committee. One plan is being developed with the idea of promoting formal investigations of the many problems involved in the teaching of problem-solving. Another plan is being developed to encourage the chairman of state science teachers' associations to give "Problem-Solving" a prominent place on their state programs. A third plan of action is being considered in which science teachers in selected schools will be encouraged to try out different techniques for teaching problem-solving. In the committee's fourth plan of action, existing channels for reaching science teachers will be used to obtain information regarding ways in which those science teachers are attempting to teach problem-solving.

The present membership of the committee has been divided into four teams. Each team will assume responsibility for one of the plans of action described in the preceding paragraph. The names of teams, team leaders and their addresses are listed below:

1. Investigations in Problem-Solving. J. Darrell Barnard, School of Education, New York University, Washington Square, New York 3, N. Y.
2. State Science Teachers' Associations. Edith M. Selberg, Colorado State College of Education, Greeley, Colorado.
3. Problem-Solving in Selected Schools. Elsa M. Meder, Associate Editor, Houghton Mifflin Company, Boston, Mass.
4. Promising Practices in Teaching Problem-Solving. N. Eldred Bingham, Northwestern University, Evanston, Illinois.

Because of the nature of the problem area which it has selected, the committee desires to extend its activities into all school levels

from elementary through junior colleges. It further wishes to expand its membership to include representatives from each of the school levels as well as a more complete representation from different sections of the country. Anyone who is interested in working with some one of the teams is encouraged to get in touch with the leader of that team.

It is not anticipated that the projects briefly described in this report will be completed within the next year or two. As the work proceeds many new problems will undoubtedly be discovered which may indicate a need for modifying presently proposed projects as well as adding other projects. It is the hope of this committee that within the next ten or twenty years such a concentrated attack upon problem-solving will result in science teachers knowing more about problem-solving and doing more about it in their science classes.

Periodic progress reports will be prepared by the committee as work on the various projects is carried forth. Whenever the findings of project teams reveal information that would be valuable for science teachers, it is hoped that special reports may be published and made available to science teachers.

MEMBERSHIP OF COMMITTEE ON RESEARCH IN SECONDARY SCHOOL SCIENCE

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REPORT OF THE RESEARCH COMMITTEE ON JUNIOR COLLEGE SCIENCE *

THIS study was undertaken with a view to determining the present status of general education science teaching at the junior college level. It has included:

1. Types of courses being offered.
2. Methods being used.
3. Extent to which research is going on and new developments are in progress.
4. Extent to which recent developments in science are being incorporated into actual teaching.

The committee decided that in undertaking this work it was necessary to go beyond the list of institutions which operated strictly as junior colleges. Therefore general education science offerings at four-year institutions were investigated also. In general, the committee limited its investigation to "first-level" courses, but they did not exclude courses offered in the last two years of undergraduate work in cases where these were clearly of a general educational nature. It was well that the committee did not limit its study to junior colleges strictly, since to have done so would have given a very incomplete picture.

The members of the committee wish to express appreciation to Dr. S. Ralph Powers, Dr. W. W. Charters, and Dr. Philip N. Powers for aid and advice in furthering the progress of the work. Appreciation is also due to the busy teachers and administrators who took the time and effort to answer the letters sent by the committee.

It was apparent from the beginning that the best the committee could hope to do in the time at their disposal would be to make a partial survey of what was being done, rather than a complete analysis or a statistical study. An effort was made therefore to obtain a general picture with the hope that the outlines could be filled in with further study.

Approximately 375 institutions were con-

* Report made by the Chairman of the Committee, W. C. Van Deventer.

tacted, and replies were received from 171, or approximately forty-five per cent. All were asked the following four questions:

1. What first-level courses in science, other than traditional type zoology, botany, chemistry, physics and geology courses are being offered in your institution?
2. What types of instruction (e.g., lecture-laboratory, lecture-demonstration or any other) are used in these courses?
3. Are any persons or groups, such as faculty committees, in your institution carrying on investigation or experimentation to determine possible new course patterns adapted to changing needs and/or interests of students?
4. In such new course patterns what attention is being paid to the problems raised by atomic energy, recent developments in the field of medicine, and other war and post-war scientific developments?

Teachers colleges and other four-year institutions were included in the survey as well as junior colleges. Institutions represented by the membership of the N.A.R.S.T. were considered in a special category because of amount of science education research being carried on in them. About 70 of these were surveyed. These were used as a check group to furnish a basis for comparison with what was being done elsewhere.

In the four-year institutions, other than those represented by members of this organization, some type of integrated science course is included in the curriculum in about half of the total cases. This offering is usually in the form of a physical science or biological science survey. These courses are presented by some type of lecture-demonstration-laboratory combination. The physical science course is presented without individual laboratory work more frequently than the biological. A great many schools are using audio-visual aids, and some in their replies made special mention of field trips and special use of the library.

In a majority of these schools the job of working out new course patterns is being

carried on, either by regularly constituted faculty groups or by special committees set up for the purpose. A third or more of them, however, are doing nothing at all in this direction.

The problem of the incorporation of new developments in science is being met in four different ways:

1. The community is used as a resource in science teaching.
2. Pertinent current problems are dealt with when they arise in the general courses.
3. Specific attention is given to new developments and their social implications in the general science courses.
4. In a few cases new courses or units are being organized to deal with new problems such as atomic power.

There is not much evidence, however, of a concerted effort being made to deal with the general education problems brought on by the atomic era.

Special mention needs to be made of the Negro colleges. Most of these are not involved in general education approaches except incidentally. The majority of them offer only traditional-type courses. Only about twenty per cent give any kind of general survey courses. Also only ten per cent have committees at work to study problems of curriculum revision or integration.

This survey apparently indicates that the general education movement has not yet affected Negro colleges even to the extent that it has reached college science work as a whole. This lack may be attributed in part to the fact that Negro college science teachers frequently do not have the background or experiences necessary to enable them to make the adjustments necessary for developing and teaching new types of courses. It is undoubtedly also due to the unhealthy social conditions under which most Negro colleges are forced to operate.*

In the section of the study having to do specifically with junior colleges 127 of the 437 institutions of this type listed in the

Educational Directory for 1946-47 † were contacted. These were selected so that they were geographically distributed by states, and included all types; Public and private, men's, women's and coeducational. Replies were received from 70 of them or approximately fifty-five per cent.

Most of these colleges offer nothing in the way of first-level science other than orthodox special-field courses. Only about thirty per cent of those replying offer any kind of integrated science courses at all.

Most of them utilize the lecture-laboratory method, or a combination of this with demonstrations. However in some cases the replies indicate that experimentation is going on in the use of other teaching methods and materials.

Only twenty-seven per cent of the junior colleges reported that they had committees at work on course revision. Letter after letter, however, expressed interest in the development of new course patterns and the reorganization of curricula. Many schools which are not already making plans for reorganization stated that they would begin work soon, or that there was discussion in this direction among the faculty, or that the need for a new approach was realized. A great many of the replies expressed interest in the work of this committee and a hope that they might receive a report of it.

About one-fourth of the junior colleges indicated that attention was being given to problems arising from the use of atomic energy and other socially significant recent scientific developments.

The general feeling that the committee had on completing their investigation of the various groups of four-year institutions and junior colleges was one of disappointment. They had hoped and expected to find more significant development in progress than they found. Within the check group of N.A.R.S.T. schools, however, there seemed to be a great deal going on.

* See *Meeting the Needs of Negro Teachers* by Edward K. Weaver in this issue of SCIENCE EDUCATION.

† Educational Directory, Part 3, Colleges and Universities. 1946-1947. Federal Security Agency, Office of Education, Washington, D. C.

The vast majority of these (82 per cent of those replying) are offering some kind of integrated general education science courses. Furthermore a great many are experimenting with various types of integrated courses other than surveys. Practically all of the experimentation of this type that appeared in our study was taking place among this group of schools. It seems therefore that this organization is giving to science teaching the kind of leadership that it needs. Unfortunately, however, the results of that leadership are not being as widely disseminated as they might be. It seems to the committee that this indicates a problem that needs some consideration by this committee.

In the matter of method these schools offer a wide range of student experiences in addition to the usual lecture-demonstration-laboratory procedure. These special method variants include field trips, audio-visual aids, discussions, special use of the library, projects, current periodicals and special stress on teaching scientific method.

About two-thirds of these schools have committees at work on new course patterns, and about half of them are giving attention to problems occasioned by recent scientific developments. This last figure might leave something to be desired, but even so it is at least twice as high a percentage as occurs in any other group.

In connection with the survey, a review was made of an extensive list of bibliographic sources dealing with the nature and objectives of general education. This material dealt largely with the trends in general education theory during the last ten years. In this way it serves as a background against which we can place the various types of courses represented in the institutions which were included in our survey, and see them in some degree of order.

In general, three major types of general education science courses appear to be distinguishable on the basis of goals, choice of integrating factors, and method of approach. These are all represented

among the institutions that the committee contacted. They are:

- (1) "Survey" courses.
- (2) "Problems" courses.
- (3) "Cultural heritage" or historical courses.

The survey course places emphasis on subject-matter from the standpoint either of areas or of principles, and brings in problems or historical material primarily for purposes of motivating learning or furnishing illustrations. The problems course begins with problems, and uses subject-matter as a means of implementing or dealing with these. Historical material is brought into such a course with this same end in view. The cultural heritage course is developed on the assumption that the best way to promote an understanding of the role of science in modern life is to study how it came to be this way. The resolution of problems and the coverage of specific subject-matter areas and principles may or may not be a primary objective of this study. Courses based on surveys of the needs of society and its members (after the manner of the Harvard report)* represent approaches having some affinities with all three of these major types.

Each of the three major types is surrounded by a widely ranging group of variants, many of which tend to partake of two or all three of them, and thus are situated at various positions between or among them. It would seem possible to schematize the picture of the general education science course field in the form of a triangle, with the corners representing the major types and the variants and combinations occupying intermediate positions along the sides or toward the center.

Such a diagram would of course constitute an over-simplification of the true situation, but its use might be justified as a means of cutting through the welter of detail and controversy that characterizes the field at present.

* "General Education in a Free Society." Report of the Howard Committee. Cambridge (Mass.), The University, 1945.

Of these kinds of integrated courses, the survey type is by far the most common. Only three of the junior colleges depart from this pattern. Among the survey courses, most are either generalized physical science or generalized biological science. Only a few institutions have combination courses including material from all fields of science. The physical science surveys generally outnumber the biological.

Of the integrated courses other than surveys, the problems type and its variants are more frequently used than the cultural-heritage type.

Possibly the most interesting feature of this survey has been the further problems that it indicates but leaves unanswered. The movement toward the development of various types of integrated courses has been with us now for many years. There is not much lack of agreement as to what such courses are designed to do, or what kind of students they are designed to serve. There is little real agreement, however, as to what should be included in them, how they should be integrated, how they should be motivated, and how they should be taught.

Should they be organized around subject matter areas and principles? If so, what subject matter and what principles? Should they be based on problems? If so, what problems, and how should the problems be selected? Should they "cover ground," and be "stretched thin"? Or should they concentrate on methods and techniques and hope for "carry-over"? Can the most vital and effective understanding of what science is doing in our present-day world be achieved through a study of the history of science? To what extent can student interest in and consciousness of problems be used as a legitimate motivator and a guide to what should be included in a course? How far should a teacher go beyond student consciousness of needs to include topics just because he thinks they ought to be included?

It seems as if it might be time for us to try to recognize some basis by which those

who are responsible for teaching science to a particular type of student in a specific situation can set out to determine what should be included in a course designed to make science function in their lives. Such a basis, of course, cannot exclude the teacher's subjective judgment. Neither can it exclude the opinions and experiences of others who are doing similar jobs elsewhere. But it cannot rest upon authority. It must be derived fundamentally from the needs of the students that it serves.

The type of research which this indicates need not require detailed statistical studies, although such may well be involved in it. Principally, it should consist of free, informal experimentation by the individual teacher, trying this and trying that with comparable groups of students; and then attempting to judge objectively what has worked best, retaining the practical and discarding the rest, however sacred it may be from the standpoint of educational and scientific tradition.

The product of this pragmatic approach may not be uniform, but it will probably be as uniform as the needs of students are. It is by this type of evolution that we may best hope to find a real answer to our problem.

SUMMARY

1. The institutions represented in the N.A.R.S.T. are definitely a picked group with regard to the development of research and experimentation in science teaching. No other group of schools is making comparable progress.

2. Interest in integrated science courses of various kinds is on the increase in all types of institutions. More progress in this direction has been made in teachers' colleges than in other four-year institutions, and the least progress of all has been made in junior colleges and in Negro colleges.

3. A great many institutions of all kinds have committees studying the problem of establishing new types of science courses. Some of these committees are simply the regularly established agencies for curricular revision, while others have been especially set up for the purpose. A great many schools that are not making such studies say that they are planning to do so, or at least recognize the need for it.

4. Most schools are using lecture-laboratory-demonstration techniques. A few are combining various types of student experiences in an inte-

grated approach to learning. Most of them are utilizing audio-visual aids or other enrichment types of materials, and some have introduced diverse teaching procedures such as field trips and special library studies.

5. Less than half of the schools surveyed are dealing, in their general education courses, with the problems raised by the development of atomic power and other recent contributions of science.

6. Of all non-traditional science courses, the survey course is by far the most widely known and best established. Other types, such as the "problems" and "cultural-heritage" courses, and various combinations derivable from them, are still a subject for extensive experimentation with much discussion of educational theory and little in the way of common ground upon which to proceed in evaluating them.

RECOMMENDATIONS

The committees feels that this study should be continued along the following lines:

1. To attempt to discover and define more closely the nature of survey courses, problem courses, cultural-heritage courses and other combinations and variants in use in specific institutions. From this study should result a usable classification of existing courses, which would facilitate further work.

2. To attempt to obtain a definition of goals from institutions utilizing varying approaches to general education science teaching, and if possible to correlate these. From this might result a set of common objectives and principles.

3. If enough of a common ground could be discovered or developed, the next logical step would be to attempt a comparative study and evaluation of the different types.

A study of this kind should prove useful to schools planning to establish new courses, and in the opinion of the committee would constitute a worthwhile service that the N.A.R.S.T. could render to college science teaching in general.

CHARLES W. REYNOLDS

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CHILDREN'S CONTRIBUTIONS IN SCIENCE DISCUSSIONS *

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THE Thirty-first Yearbook of the National Society for the Study of Education¹ indicated the importance of certain objectives for science instruction in the elementary school. Some of these objec-

* Hill, Katherine E. *Children's Contributions in Science Discussions.* New York: Bureau of Publications, Teachers College, Columbia University, 1947.

¹ Powers, S. Ralph, and Others. "A Program for Teaching Science." *Thirty-first Yearbook of the National Society for the Study of Education, Part I.* Bloomington, Ill.: Public School Publishing Company, 1932.

tives were indicated earlier in a study by Craig.² Since that time science educators have been concerned with the practical possibilities of the use of these objectives by classroom teachers in the organization of their work with children in science. Some research along this line has taken place from time to time. For instance, a study

² Craig, Gerald S. *Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School.* New York: Bureau of Publications, Teachers College, Columbia University, 1927.

by Haupt³ reported that children in the elementary school, after the study of certain subject matter, are capable of making a generalized statement concerning it and are also capable of growth in the understanding of that subject matter. West's⁴ study indicates a technique which can be used in the evaluation of the objectives for instruction in elementary science through an analysis of the observable behavior reactions of children. The concern of this study, then, was to investigate some of the suggested objectives with respect to their appropriateness for the instruction of young children.

It was necessary to choose an elementary school, where the study could be carried out, in which two conditions could be fulfilled. First, the classroom teachers in this school had to have as their objectives those which were under investigation. Secondly, a science program based upon these objectives must have been in progress in this school for at least six years so that those children in the sixth grade would have worked through a continuous program. This latter condition was necessary since it seemed logical that older children with more science experience might reveal more progress in terms of the chosen objectives than younger children who had less science experience, provided the objectives were appropriate for science teaching.

It may be seen, therefore, that the basis of judging the appropriateness of the objectives investigated was directly related to whether or not children who had been taught with the objectives in mind showed any progress in respect to these objectives.

COLLECTING THE DATA

Criteria used in selecting objectives for science instruction, as reported in the

³ Haupt, George W. *Experimental Application of a Philosophy of Science Teaching in an Elementary School*. New York: Bureau of Publications, Teachers College, Columbia University, 1935.

⁴ West, Joe Young. *A Technique for Appraising Certain Observable Behavior of Children in Science in Elementary Schools*. New York: Bureau of Publications, Teachers College, Columbia University, 1937.

Thirty-first Yearbook and in Craig's study, were analyzed to determine basic objectives. This analysis produced the following objectives: Recognition and Identification of Natural Phenomena, Inquiry, Speculation, Cause and Effect Relationships, Conclusions, Recognition of Achievements of Thinking, "Critical-mindedness," "Open-mindedness," Responsibility and Cooperation, Initiative, Application of Experience, and Skills. These objectives were studied by the teachers cooperating in this study. It was found that the teachers felt that these objectives adequately stated their own objectives.

It was necessary, in collecting data for this study, to use a method which would give information as to both number and type of responses made by children during science discussions. Therefore, it was decided to record each child's remarks under one of the objectives being studied or else in a thirteenth category, Miscellaneous.

Accordingly, a code was devised by carefully defining each of the objectives. When a child made a remark, the remark was to be classified and the appropriate code number was to be entered opposite that child's name.

In order that the investigator might have confidence that the code was clearly defined and usable, a matching test was devised, using the verbatim remarks of children from a second and a fifth grade. Five impartial judges independently classified each remark under one of the categories. The percentage of agreement between the judgments of the investigator and of the five independent judges ranged from 83 to 90.

After the code was set up so that it seemed workable, it was necessary to determine whether the investigator was making accurate analyses of the remarks under actual classroom conditions. The investigator then made independent recordings along with each of two observers in several classroom situations. The percentages of agreement between the judgments

of the observers and of the investigator were high enough to justify the investigator in placing reasonable confidence in the records obtained.

Data, then, were obtained during two periods, where each period consisted of sixteen consecutive observations, in each of the six grades in the elementary school chosen.

A second method of collecting data was also used. This was to record verbatim the remark made by a child opposite that child's name. Remarks were recorded in a combination of longhand and shorthand. If there was time to record a remark verbatim, it was recorded. In this manner 26 per cent of the total number of coded remarks for all grades were also recorded verbatim. With the exception of four instances, namely, Skills in Grade 1 and Recognition and Identification of Natural Phenomena, "Open-mindedness," and "Critical-mindedness" in Grade 4, 10 per cent or more of the responses assigned to each category were recorded verbatim. The sampling of remarks in these four instances was quite limited.

ANALYSIS OF THE DATA

An analysis of the coded remarks was made with the original purpose of the study in mind, that of determination of the appropriateness of the objectives as teaching goals for elementary science instruction. One indication of the appropriateness of the objectives was whether or not children's natural contributions in a science discussion were related to the objectives. In examining the data, it was found that responses had been made, in each of the six grades, which were classified as representing each of the objectives. Of course, there were some children in each grade who did not make remarks which could be classified in each category. The greatest number of responses were classified as representing Recognition and Identification of Natural Phenomena, Inquiry, Speculation, and Cause and Effect Relationships.

A more detailed analysis was then under-

taken in regard to each objective. It was found that 80 to 100 per cent of the children in each grade made responses which were classified under each of these objectives. On the basis of these results, these four objectives, Recognition and Identification of Natural Phenomena, Inquiry, Speculation, and Cause and Effect Relationships, seem appropriate as goals in elementary science instruction.

But 32 to 73 per cent of children in the six grades made responses in terms of the objective, Conclusions. This did not rule out this objective, however, since it seemed reasonable to draw relatively few conclusions in relation to the number of questions, speculations, and statements of fact which are made in a discussion.

On the basis of the same type of percentage analysis of children making responses classifiable under each objective, it is held that the objectives "Critical-mindedness," "Open-mindedness," Responsibility and Cooperation, Initiative, Application of Experience, and Skills are also appropriate as goals in elementary science instruction.

Very few responses were made by very few children that could be classified as Recognition of Achievements of Thinking. This type of response may be so mature or so unrealistic that it should not be expected from young children. On the other hand, perhaps the most adequate expression of appreciation of others is to refrain from interrupting. If this is true, teachers might continue to hold this objective in mind since appreciation may be developing even though there is little verbal indication of it.

It is interesting to note that the pattern of total response does not differ greatly from grade to grade. There was no indication of a continuous change in terms of greater numbers of responses at higher levels.

It seems important to note, however, that responses which could be classified in the twelve categories representing the objectives for science in the elementary school were made in all grades. This is evidence

that the objectives which have been set up by certain science educators are appropriate in that children are able to respond to these objectives.

Another basis for judging the appropriateness of the objectives was that of investigating the relative excellence of the verbatim remarks of the children. It seemed that remarks in the science area might give evidence of the use of previous experience and of previously gained knowledge, of the use of detailed information, of understanding and interpretation of an experience, of discrimination, of concern with accuracy of information, of willingness to deal with new ideas and possible explanations, of desire to plan for experience as the basis for a conclusion, and of delaying final conclusions until more accurate information is available.

Since so many remarks had been recorded verbatim, it was necessary to limit the number studied. Therefore, only remarks pertaining to Recognition and Identification of Natural Phenomena, Inquiry, Speculation, Cause and Effect Relationships, and Conclusions made by the children in Grades 1, 2, 5 and 6 were used.

The next step was to develop criteria, which might be used to define further some of the responses made in a science discussion. An analysis of the verbatim remarks chosen for study resulted in the following criteria:

Recognition and Identification of Natural Phenomena

1. Evidence of wider understanding and interpretation of natural phenomena. Is there evidence of reaching beyond mere identification?
2. Evidence of recognizing relatedness of natural processes.
3. Evidence of use of experience as a basis of information given.
4. Evidence of use of rather detailed information.

Inquiry

1. Evidence of desire for deeper understanding. Do the queries show desire to understand more fully rather than merely to identify?
2. Evidence of desire for more accurate information.

3. Evidence of desire to acquire information for some use.

Speculation

1. Evidence of relationships receiving greater emphasis as a part of speculation.
2. Evidence of child advancing own ideas in solution of a question.
3. Evidence of child suggesting an experience to aid in solution of a problem.
4. Evidence of use of previously acquired information as basis for advancing idea as to the solution of a problem.

Cause and Effect Relationships

1. Evidence of distinguishing between cause and effect or between fact and opinion on the basis of previously acquired information.
2. Evidence of use of facts as a basis for discarding previously held ideas.
3. Evidence of concern with the way in which man goes about acquiring information.

Conclusions

1. Evidence of use of reflection or of experience as basis for statement.
2. Evidence of a tendency to understand a principle rather than to be content with a mere statement of facts.
3. Evidence of the formation of a conclusion after considering several points of view.

An attempt was then made to determine whether or not three judges would find differences in responses of younger and of older children when using the above criteria. The remarks presented to the judges were selected from the first and sixth grades. Only one response made by any one child in any one category was used. The remark chosen was the first one recorded opposite that child's name. Each remark was typed on a separate card. Five packs of cards were obtained, one pack for each objective. The cards were thoroughly shuffled and each judge was asked to rank the cards in each pack in order of excellence, using the investigator's criteria as a basis for judgment. Agreement among the judges in placement of remarks in all but four cases was 80 per cent or above.

An examination of the ranked responses revealed that each judge consistently judged the majority of the sixth grade remarks as better than the majority of the first grade remarks. Sixth grade remarks

classified as Recognition and Identification of Natural Phenomena, as Speculation, and as Conclusions seemed to reveal more of the characteristics set up for each of these types of remarks than did the Inquiry and the Cause and Effect Relationships remarks of sixth graders.

It seemed, then, that there was a recognizable difference between the remarks of those children who had had more science experience and those who had had less such experience. Remarks of older children seemed to be more discriminatory than those of younger ones. Those made by older children more often involved more than one idea, with a consequent comparison of these ideas. Those of older children revealed a broader basis of information and experience. It may be that the wider information and experience enabled older children to make more discriminatory remarks.

The statements of both older and younger children showed a recognition of the relatedness of events, although it was more often evident in those of the former.

A few of the responses of younger children revealed a desire for proof. However, this characteristic was much more evident in the responses and especially in the questions of older children. Younger children seemed more often to be concerned merely with the question of the identity of an object, whereas older children revealed more concern with why something happened or how it happened.

Children at all age levels seemed inclined to offer suggestions for the possible solution of a problem. However, the speculative statement of older children more often included a reason for the speculation. Some children proposed that an idea be tested by performing an experiment. Such suggestions were more often made by older children.

Many of the conclusions made by younger children were statements of fact as those children saw the facts. The conclusions of older children were more apt to be of a tentative nature, including some

statement of ideas on which the conclusions were based.

Briefly, then, the statements of older children seemed to reveal certain characteristics of a more mature or considered type of thinking. It may be that the analysis of a child's responses, in relation to some of the characteristics discussed in this study, may give a clue to the child's mental progress.

IMPLICATIONS FOR SCIENCE EDUCATORS

First, the objectives listed in this study seem appropriate as goals in elementary school science instruction. Secondly, since it was found that more responses were made which could be classified as representing the objectives, Responsibility and Cooperation, Initiative, Application of Experience, and Skills, when experimental materials were more often being used by children, curriculum makers may wish to urge that children be allowed to engage in this type of activity as well as in the reading-discussion type of activity in science.

A third implication is that no progress was apparent so far as an increase in number of responses was concerned. Three judges, however, did find recognizable differences in the responses of first and sixth grade children when those responses were considered in the light of certain characteristics expressed in the form of sets of criteria proposed by the investigator.

It is urgently suggested, therefore, that those educators interested in science in the elementary school consider the redefinition of the objectives analyzed in this study, or whatever other objectives are held to be important, in terms of relative excellence of response at the various age levels. The investigator has presented certain criteria for the "goodness" of responses which might be related to the first five of these objectives, but much more needs to be done along this line.

The redefinition of objectives in elementary science instruction is of much importance if classroom teachers who wish

to judge the effectiveness of the experiences of groups in their charge are to be helped. It is relatively easy for teachers to test for subject matter learnings. But if we are to help those who are endeavoring earnestly

to work toward larger goals, we must give them a basis for the evaluation of the progress of the children whom they are guiding toward larger understandings, abilities, and attitudes.

RESEARCH IN NUTRITION EDUCATION IN THE PUBLIC SCHOOLS

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TECHNIQUES OF INVESTIGATION

For the past two years a study in health education, with specific emphasis on nutrition, has been underway in the Department of Nutrition of the Harvard School of Public Health. This study has been financed in part by a grant-in-aid from the Nutrition Foundation, Inc., New York City. The purpose of the research has been to improve techniques of nutrition education and to determine whether or not nutrition education, when incorporated into the curriculum, would aid in influencing and changing the food habits of children.

The underlying principle and determining factor for this study has been to develop techniques whereby *any* school system, large or small, urban or rural, of few teachers or many, could conduct a similar study to improve the food habits of its children. Consequently, all or any part of this completed study can be duplicated by a school system as a whole, or by the administration and faculty of one particular school, or by the solitary teacher of a one-room school. Community cooperation is vitally necessary since interests and habits established in school must be encouraged through the home. Therefore, it is necessary for parent education in nutrition to accompany that within the school.

The study employs the curricula of all grades from kindergarten through grade 12. To facilitate the statistical evidence necessary, the program concentrated at the elementary level (kindergarten to grade 6)

during the school year 1946-1947; it is concentrating at the junior high level (grades 7 to 9) during the present year (1947-1948); and will concentrate at the high school level (grades 10 to 12) during 1948-1949.

The study was conducted in the public schools of Newton, Massachusetts, a suburb of Boston with 22 elementary schools, four junior high schools and one senior high school. The Superintendent of Schools in Newton, Dr. Homer W. Anderson, and his entire staff have been very cooperative and assisted materially in the project. A Nutrition Curriculum Committee with representation from the administration, the various teaching levels and subjects, the Newton Nutrition Center, the school nurses, the Parent-Teacher Association, etc., was established as a clearing house for this study. Through this Nutrition Committee, a survey was made at the various levels to determine what nutrition education already was being carried on by the schools. The Committee assisted in setting up the experimental study. They discussed ways and means for acquainting the schools and communities with nutrition information and nutritional needs.

In the fall of 1946 an extension course in nutrition was offered to the teachers of Newton. The instruction was provided largely by the Department of Nutrition, Harvard School of Public Health. This met one afternoon a week and offered credit at either Harvard or Boston University.

Some 150 teachers availed themselves of this course giving basic information and techniques.

Six elementary schools were chosen in 1946 to participate as experimental schools. The student intelligence quotient was as comparable as is possible in dealing with entire school enrollments. Two of these six schools served as controls,* two were given teaching aids in the way of pamphlets, posters, charts, films, film strips, etc., having to do with nutrition at the elementary level. The remaining two schools were given the Teaching Aid Kits plus workshops, demonstrations and personal conferences to discuss ways and means of incorporating nutrition education into the health education, science, social studies, reading, arithmetic, etc., of the elementary curriculum.

Dietary surveys were conducted before introducing any nutrition education. These surveys provided a dietary picture, not only for each individual child and for his grade, but also for the school as a whole and for the community. Since the survey was repeated during the year, in March and in June, a seasonal food picture also was obtained.

The community areas of Newton vary from the older sections, built by the workers of the many small industries thereabouts, to the newer sections, mainly inhabited by the professional class. Of the six elementary schools chosen, three (Bowen, Emerson and Carr) included the children from the older sections. The other three schools (Peirce, Angier and Ward) were in more recently built communities of better homes, as economically rated. Thus a picture was obtained within the experimental set-up as to food habits of communities of different economic standings.

The dietary surveys were taken for a three-day period with Tuesday, Wednesday and Thursday being selected as the more

average days for the week. Notes of explanation were sent to all parents. In the kindergarten through third grade, the parents were requested to fill in the dietary booklets provided for the purpose. Children of grades 4 to 6 completed their own, taking a short time each morning and afternoon from the school day. Cross checks of various types were used to validate the information going into the booklet.

The dietary information from the booklets was tabulated according to the basic seven food groups as established by the United States Department of Agriculture during the war. The criteria for amounts of servings were based on the recommended allowances for children of this age as established by the National Research Council. The following food groups were tabulated for each of the three-day periods: meat or equivalent (fish, fowl, eggs, cheese, legumes); breads and cereals; green and yellow vegetable; potato; vegetables other than potatoes and green and yellow; all vegetables; citrus fruits or equivalent; fruits other than citrus; all fruits; milk. Desserts, soft drinks, candy, cod liver oil, and vitamin intake were also tabulated but not considered a part of the daily basic diet. Space was left on the tabulation sheets for comments about food or meal habits such as coffee or tea drinking, poor breakfasts, etc. Copies of these tabulations by grades were returned to all teachers other than in the control schools. Thus each teacher had an over-all view of the dietary habits and needs of her particular group. This formed the basis for determining the nutrition education that she did.

The majority of the teachers expressed the need for an outline or a listing of the aims of the nutrition education program so as to know the possibilities for inclusion into the curriculum. As a result, the "Goals for Nutrition Education" were developed. These gave a broad over-all view of the major and specific objectives, practical for the early elementary (kindergarten to grade 3), the later elementary (grades 4

* No teacher in either of the two control schools was enrolled in the special nutrition course mentioned above.

to 6), and the junior and senior high school levels.

In the two schools having workshops, the program was planned as follows: Using the needs for each grade as determined by the dietary surveys, plus the "Goals for Nutrition Education" and the kits of teaching aid materials, the teachers were then assisted in planning the incorporation of nutrition education into their health education, science, social studies, and other related fields. Since there was little health education as such, the nutrition program fell mainly into the elementary science and social studies. Usually, however, the topic or goal chosen for emphasis, since it was based on needs, was developed in such a way as to permit the incorporation of the entire curricula in contributing to its attainment.

The two schools (Ward and Carr) wherein workshops were conducted, carried on many worthwhile projects. These ranged from general discussion of all seven basic food groups to specific groups needing emphasis by a particular grade to improve their diets. Acquaintance with new foods and with those commonly disliked by young children helped in forming better attitudes about these foods. Several school breakfasts and lunches served as patterns since these two meals were the poorest of the day as determined by the surveys. The older children discussed and carried on activities related to soil requirements, gardening, food preservation, and food conservation. Food customs characteristic of the different nationalities found within Newton provided insight and inter-community understanding for presentation. One class at the second grade level conducted its own two months' experiment in better health habits. Heights and weights were taken and tabulated, necessitating arithmetic; daily diets were listed, necessitating spelling and writing; basic food groups learned and why boys and girls needed them for health, involving science; sources of food, their transportation and the community

agents necessary for the buying and selling of different types of foods, brought in social studies. After two months of "better health practices," it was opportune that all children did increase in weight and height. Also, several of them improved noticeably in their school work.

RESULTS

The peak of nutrition education as a daily part of the curriculum occurred from December through April. May and June found the schools busy with various terminating school activities. This let-up of daily incorporation of emphasis on foods and food habits was reflected in the tabulated results of the June Surveys. However, the three basic food groups needing the most emphasis at the beginning of the study—green and yellow vegetables, citrus fruit or equivalent, and milk—all showed an improvement by reducing the number of children deficient in those basic groups. The March surveys, taken during the period of intensified nutrition education, showed the optimum of gain. The June survey results, while lower than the March surveys, were still an improvement over the October surveys.

With the two schools (Angier and Emerson) where there were only the teaching aids, the picture showed marked declines in *all* basic food groups, particularly in the green and yellow vegetable group (62 per cent to 37 per cent), in the all vegetable group (75 per cent to 59 per cent), in the fruits other than citrus (69 per cent to 37 per cent), and in the milk (84 per cent to 67 per cent). The two control schools (Peirce and Bowen) also showed certain declines through the school year. The green and yellow vegetable group in October showed 35 per cent of the children adequate for the three-day period, which dropped to a 29 per cent adequacy by June. The number of children adequate in milk in October, 1946, was 63 per cent, by June it had declined to 57 per cent. Surprisingly, they showed a marked in-

TABLE I
DIET SURVEYS

Schools—Newton	Control Schools						Teaching Aids Only						Teaching Aids—Workshop						
	Pierce—Bowen			6/47			Angier—Emerson			6/47			Ward—Carr			6/47			
	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%		
Survey Dates	10/16	3/47	216	213	96.67	165	90.92	150	90.92	491	87.53	391	88.27	285	85.59	460	93.31	358	89.96
Enrollments Used																		398	
Meat	A*	196	90.74	191	89.67	150	90.92	150	90.92	22	3.92	22	4.96	18	5.40	11	2.33	18	3.35
or	M	8	3.71	9	4.22	6	3.63	6	3.63	48	8.55	30	6.77	30	9.01	22	4.46	22	3.90
Equivalent	D	12	5.55	13	6.11	9	5.45											17	4.27
Breads	A	150	69.44	168	78.87	126	80.01	501	89.13	378	85.33	288	86.79	241	48.90	393	73.05	255	64.08
and	M	62	28.71	31	14.55	30	18.18	54	9.10	50	11.29	38	11.41	176	35.69	121	22.49	99	24.37
Cereals	D	4	1.85	14	6.57	3	1.81	6	1.07	15	3.38	6	1.80	76	15.41	24	4.46	44	11.05
Green and	A	77	35.64	70	32.86	48	29.03	346	61.84	232	52.38	123	37.24	233	47.27	279	51.87	168	42.22
Yellow	M	62	28.71	67	31.45	44	26.66	116	20.68	132	29.79	86	25.52	94	19.06	114	21.18	90	24.87
Vegetables	D	77	35.64	76	35.68	73	44.31	99	17.47	79	17.83	124	37.24	166	33.67	145	26.95	131	32.91
Potatoes	A	117	54.16	115	53.99	84	50.91	278	49.56	219	49.44	167	46.85	243	45.24	277	51.49	202	50.76
and Other	M	16	7.40	27	12.67	12	7.27	49	8.73	61	13.77	40	12.01	40	8.11	46	8.55	35	8.79
Vegetables	D	83	38.42	71	33.33	69	41.82	234	41.71	163	36.79	138	41.14	230	46.65	215	39.96	161	40.45
All	A	131	60.65	139	65.25	99	60.01	422	75.23	315	71.06	196	58.87	317	64.31	377	70.07	253	63.57
Vegetables	M	29	13.42	35	16.43	22	13.33	48	8.55	64	14.47	50	15.01	51	10.34	60	11.15	55	13.81
	D	56	25.92	39	18.31	44	26.66	91	16.22	64	14.47	87	26.12	125	25.35	101	18.77	90	22.61
Citrus Fruit	A	91	42.12	116	54.46	100	60.60	296	52.77	268	60.52	173	51.95	313	63.50	391	72.69	289	72.63
or	M	47	21.75	49	23.00	20	12.12	88	15.68	67	15.12	65	19.52	* 86	17.44	64	11.89	47	11.80
Equivalent	D	78	36.11	48	22.53	45	27.27	177	31.55	108	24.36	95	28.53	94	19.06	83	15.42	62	15.57
Fruits	A	122	56.48	111	52.11	69	41.82	386	68.99	218	49.22	124	37.27	280	56.80	282	52.42	155	38.95
Other Than	M	44	20.37	53	24.88	32	19.33	70	12.30	95	21.44	70	21.02	71	14.40	87	16.17	76	19.09
Citrus	D	50	23.14	49	23.01	64	38.85	105	18.71	130	29.34	139	41.71	142	28.80	169	31.39	167	41.96
All	A	160	74.08	168	78.87	119	72.13	457	81.47	342	77.20	233	69.98	411	83.38	465	86.44	317	79.65
Fruits	M	13	6.30	12	5.63	4	2.42	13	2.31	17	3.84	17	5.10	9	1.82	7	1.30	8	2.01
	D	43	19.90	33	15.50	42	25.45	91	16.22	84	18.96	83	24.92	73	14.80	66	12.26	73	18.34
Citrus	A	137	63.42	132	61.97	95	57.57	470	83.78	308	69.53	225	67.57	360	73.03	391	72.69	275	69.11
All	M	61	28.24	64	30.04	56	33.95	65	11.59	112	25.28	91	27.33	86	17.44	110	20.44	92	23.11
Fruits	D	18	8.34	17	7.98	14	8.48	26	4.63	23	5.19	17	5.10	47	9.53	37	6.87	31	7.78

* Adequate, Marginal, Deficient.

TABLE II
TOTAL OF ALL ELEMENTARY SCHOOLS SURVEYED

Survey Dates Enrollments Used	10/46		3/47		6/47	
	1270	No. %	1194	No. %	896	No. %
Meat	A*	1147 90.31	1080 90.45	793 88.50		
or	M	41 3.23	49 4.10	47 5.24		
Equivalent	D	82 6.45	65 5.44	56 6.25		
Breads	A	892 70.24	939 78.64	670 74.77		
and	M	292 22.99	202 16.91	167 18.64		
Cereals	D	86 6.77	53 4.43	59 6.58		
Green and	A	656 51.65	581 48.65	339 37.83		
Yellow	M	272 21.41	313 26.21	229 25.56		
Vegetables	D	342 26.92	300 25.12	328 36.61		
Potato and	A	618 48.66	611 51.17	441 49.22		
Other	M	105 8.26	134 11.22	87 9.71		
Vegetables	D	547 43.07	449 37.60	368 41.07		
All	A	870 68.50	831 69.60	548 61.16		
Vegetables	M	128 10.08	159 13.32	127 14.17		
	D	272 21.42	204 17.08	221 24.66		
Citrus Fruit	A	700 55.11	775 64.91	562 62.72		
or	M	221 17.40	180 15.07	132 14.73		
Equivalent	D	349 27.48	239 20.01	202 22.54		
Other Fruits	A	788 62.05	611 51.17	348 38.84		
(Excluding	M	185 14.56	235 19.68	178 19.86		
Citrus)	D	297 23.38	348 29.15	370 41.29		
All	A	1028 80.94	975 81.66	669 74.66		
Fruits	M	35 .02	36 3.02	29 3.23		
	D	242 19.05	183 15.32	198 22.10		
	A	967 76.15	831 69.60	595 66.40		
Milk	M	212 16.67	286 23.95	239 26.67		
	D	91 7.17	77 6.44	62 6.92		

* Adequate, Marginal, Deficient.

crease in the citrus fruit intake and in the bread and cereal intake.

EVALUATION

In summarizing and evaluating this experimental study in nutrition education at the elementary level, it can be stated that the three-day dietary surveys were taken of over 3,300 children at three different times during the school year of 1946-1947. The schools receiving the most help through the media of workshops, demonstrations, personal conferences, visual aids, etc., showed statistical evidence of improvement in their daily eating habits, as compared with the marked decline in per cents of the number of children adequate in the basic food groups within the other schools, both those schools having only visual aids available and those schools serving as controls.

Evaluation of actual change of attitudes of children in relation to their food habits can be measured through parent, teacher, and child reactions and responses. An evaluation sheet sent one year later (January, 1948) to the homes of the 26 children who had participated in the "better health" program for the two month period, resulted in two mothers stating that their children had become lax in their desire to have daily the basic seven foods. The other 24 mothers stated that there was a definite, valuable, carry-over in regard to improved attitudes and habits in relation to food, this in spite of the fact that no nutrition education has been carried on with these children during this present school year. Both teachers and parents of other grades commented many times on the fact that improved nutritional habits of certain children within the grades, brought improved scho-

TABLE III
ELEMENTARY SCHOOLS BY ECONOMIC STATUS

Schools	Bowen—Emerson—Carr						Pierce—Angier—Ward											
	Survey Dates		10/46		3/47		6/47		10/46		3/47		6/47					
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
Survey Dates		10/46	474		3/47	479		6/47	379		10/46	796		3/47	715		6/47	517
Enrollments Used																		
Meat	A*	390	82.27		405	84.55		310	81.69		757	95.10		675	94.40		483	93.42
or	M	18	3.80		33	6.89		26	6.86		23	2.89		16	2.24		21	4.06
Equivalent	D	66	13.92		41	8.56		43	11.34		16	2.01		24	3.36		13	2.51
Breads	A	376	79.32		437	91.23		334	88.12		516	64.82		502	70.21		336	64.99
and	M	88	18.56		32	6.68		39	10.29		204	25.63		170	23.77		128	24.76
Cereals	D	10	2.11		10	2.09		6	1.58		76	9.55		43	6.01		53	10.25
Green and	A	185	39.03		229	47.80		147	38.78		471	59.17		352	49.23		192	37.14
Yellow	M	123	25.95		129	26.93		101	26.65		149	18.72		184	25.73		128	24.76
Vegetables	D	166	35.02		121	25.26		131	34.56		176	22.11		179	25.03		197	38.10
Potato and	A	195	41.14		234	48.85		179	47.23		423	53.14		377	52.72		262	50.67
Other	M	39	8.23		50	10.44		38	10.02		66	8.29		84	11.75		49	9.48
Vegetables	D	240	50.63		195	40.71		162	42.74		307	38.56		254	35.52		206	39.84
All	A	269	56.75		316	65.97		219	57.78		601	75.50		515	72.03		329	63.63
Vegetables	M	67	14.13		62	12.94		55	14.51		61	7.66		97	13.56		72	13.92
	D	138	29.11		101	21.08		105	27.70		134	16.83		103	14.40		116	22.44
Citrus	A	164	34.60		256	53.44		183	48.28		536	67.33		519	72.59		379	73.31
Fruit or	M	74	15.61		73	15.24		65	17.15		147	18.46		107	14.96		67	12.96
Equivalent	D	236	49.79		150	31.31		131	34.56		113	14.19		89	12.45		71	13.73
Fruits	A	275	58.01		226	47.18		126	33.24		513	64.44		385	53.84		222	42.94
(Excluding	M	63	13.29		72	15.03		77	20.31		122	15.32		163	22.70		101	19.53
Citrus)	D	136	28.70		181	37.79		176	46.44		161	20.23		167	23.35		194	37.52
All	A	328	69.20		345	72.02		237	62.53		700	87.94		630	88.11		432	83.56
Fruits	M	7	1.48		12	2.50		14	3.69		28	3.52		24	33.56		15	2.90
	D	139	29.32		122	25.47		128	33.77		68	8.54		61	8.53		70	13.54
	A	366	77.21		354	73.90		266	70.18		601	75.50		477	66.71		329	63.63
Milk	M	76	16.03		99	20.67		82	21.63		136	17.08		187	26.15		157	30.37
	D	32	6.75		26	5.43		31	8.18		59	7.41		51	7.13		31	6.00

* Adequate, Marginal, Deficient.

lastic standing since children were absent less, had improved health, had gains in weight, were steadier emotionally, etc. These gains would be difficult to attribute wholly to the nutrition education program even though the family physicians, parents and teachers attested to this fact.

One evaluation would be that there was definitely an improvement in attitudes regarding new foods, in children being willing to try new foods, in interest in food conservation, when nutrition education is a part of the early elementary curriculum, but that this improvement shows best results, as with all other branches of the curriculum, where there is definite and continued emphasis; that when the emphasis is short lived and then omitted, there is a rapid decline in interest in daily food adequacies of the basic food needs.

Since there has been but one dietary survey taken at the junior high level (October, 1947) at this time, it is impossible to present any evidence for that level. The first survey showed decided evidence of need for nutrition education in vegetables of all kinds, in citrus fruits or their equivalents, and in milk. There was only a 22 per cent adequacy for green and yellow vegetables, a 25 per cent adequacy for citrus fruits and a 44 per cent adequacy in consumption of milk. There was a decided increase in number of children drinking coffee and tea in the junior high school as compared with the elementary schools. In a total summary of the six elementary schools, there had been only 2.65 per cent of the children drinking coffee and 2.83 per cent drinking tea. With the junior high children, the coffee intake increase to 19.21 per cent and

TABLE IV
JUNIOR HIGH SCHOOLS

Schools Enrollment		Day Junior		Bigelow Junior		Total	
		No.	%	No.	%	No.	%
Protein.	A*	282	66.82	187	70.57	469	68.27
Meat or	M	42	9.95	22	8.30	64	9.31
Equivalent	D	98	23.22	56	21.13	154	22.42
Breads	A	396	93.84	252	95.09	648	94.32
and	M	21	4.98	11	4.15	32	4.06
Cereals	D	5	1.18	2	.75	7	1.02
Green and	A	88	20.85	66	24.91	154	22.42
Yellow	M	113	26.78	85	32.08	198	28.82
Vegetables	D	221	52.37	114	43.09	335	48.76
Other	A	115	27.25	102	38.49	217	31.59
Vegetables	M	16	3.79	7	2.64	23	3.35
	D	291	68.96	156	38.87	447	65.06
All	A	164	38.86	137	51.70	301	43.81
Vegetables	M	56	13.27	28	10.57	84	12.23
	D	202	47.87	100	37.73	302	43.96
Citrus Fruit	A	73	17.30	103	38.87	176	25.62
or	M	77	18.25	42	15.85	119	17.32
Equivalent	D	272	64.45	120	45.28	392	57.06
Other	A	143	33.89	107	40.38	250	36.39
Fruits	M	80	18.95	54	20.38	134	19.51
	D	199	47.16	104	39.24	303	44.10
All	A	193	45.73	169	63.77	362	52.69
Fruits	M	17	4.03	12	4.53	29	4.22
	D	212	50.24	84	31.70	296	43.08
Milk	A	165	39.10	138	52.07	303	44.10
	M	98	23.22	98	36.98	196	28.53
	D	159	37.68	29	10.94	188	27.37

* Adequate, Marginal, Deficient.

the tea to 8.30 per cent. The intake of soft drinks likewise showed an increase for the older children.

As with the elementary schools, reports were returned to the junior high schools, one written for the faculty and one written for the students. One junior high school presented the results of the surveys via a general assembly of its student and faculty body.

Correlation with the school cafeterias has been an important part of the nutrition education. While there has been no workshop held for teachers at the junior high level, many of these teachers had taken part in the extension course offered the previous year in nutrition.

The research study at the high school

level (1948-1949) will be mainly through the departments of health, home economics, science, social studies, and through the cafeteria. Dietary surveys will again be taken for statistical data.

It is hoped that during the coming year a similar study in nutrition education in the public schools can be established somewhere in the southern United States where the health and economic ratings of the community may not be as favorable as that in Newton. There the principles and techniques underlying the present study will be further checked and evaluated before publication of the total data as a suggested outline with procedures and techniques for the establishment of a nutrition education program for the schools of the entire country.

PROGRAM OF TWENTY-FIRST ANNUAL MEETING OF THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

ATLANTIC CITY, NEW JERSEY, HOTEL CHALFONTE-HADDON HALL
FEBRUARY 22, 23, AND 24, 1948

OFFICERS

IRA C. DAVIS, *President*

University of Wisconsin
Madison, Wisconsin

JOE YOUNG WEST, *Vice-President*

State Teachers College
Towson, New Jersey

CLARENCE M. PRUITT, *Secretary-Treasurer*

Oklahoma Agricultural and Mechanical College
Stillwater, Oklahoma

EARL R. GLENN, *Executive Committee*

State Teachers College
Montclair, New Jersey

N. ELDRED BINGHAM, *Executive Committee*

Northwestern University
Evanston, Illinois

PART I—SUNDAY, FEBRUARY 22, 6:00 P.M.—

Mandarin Room

Reception and Annual Banquet.

PROGRAM

PART II—MONDAY, FEBRUARY 23, 9:00 A.M.—

Sun Porch

Report of Research Committee on Elementary
Science.

Glenn O. Blough, Chairman, U. S. Office of
Education, Washington, D. C.

Report of Research Committee on Training of
Teachers for Elementary Science.

Florence G. Billig, Chairman, Wayne Uni-
versity, Detroit, Michigan.

Materials of Consumer Science.

George G. Mallinson, Iowa State Teachers
College, Cedar Falls, Iowa.

Development of Concepts in Elementary Science.
M. O. Pella, University of Wisconsin,
Madison, Wisconsin.

Variability in Recognizing Scientific Inquiry.
Richard H. Lampkin, State Teachers College,
Montclair, New Jersey.

Children's Contributions in Science Discussions.
Katherine Hill, Wheelock College, Boston.

PART III—MONDAY, FEBRUARY 23, 2:00 P.M.—

Sun Porch

Joe Young West, Vice-President, presiding.

Report of Research Committee on Junior High
School Science.

Earl R. Glenn, Chairman, State Teachers
College, Montclair, New Jersey.

Report of Research Committee on Secondary
School Science.

Darrell Barnard, Chairman, New York Uni-
versity, New York.

Meeting the Needs of Negro Science Teachers.

Edward K. Weaver, State Teachers College,
Montgomery, Alabama.

Suggestions for Teaching Selected Materials
from the Area of the Interrelations of
Living Things and Their Environment with
Particular Attention to Problems of Good
Land Use.

Oliver S. Loud, Antioch College, Yellow
Springs, Ohio.

Results of an Experimental Study in the Teach-
ing of Biology and Social Studies.

Homemade Pictures for Laboratory Teaching
in Biology.

Zachariah Subarsky, Bronx High School of
Science, New York.

PART IV—TUESDAY, FEBRUARY 24, 9:00 A.M.—

Sun Porch

Report of Research Committee on Science for
Junior Colleges.

William C. Van Deventer, Chairman,
Stephens College, Columbia, Missouri.

Cooperative Research for Science Education.
Hubert Evans, Teachers College, Columbia
University.

Science Education Research in U. S. Office of
Education.

Philip G. Johnson, U. S. Office of Education,
Washington, D. C.

Research in Nutrition Education in the Public
Schools.

Betty Lockwood, Harvard School of Public
Health, Cambridge, Massachusetts.

Agricultural Science to Serve Youth.

Warren P. Everote, Encyclopedia Britannica,
Films, Wilmette, Illinois.

OFFICIAL MINUTES OF THE BUSINESS MEETING OF THE
NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING
SUNDAY EVENING, FEBRUARY 22, 1948, MANDARIN ROOM, CHALFONTE-HADDON
HALL, ATLANTIC CITY, NEW JERSEY

Members present: Ira C. Davis, Jerome Metzner, Zachariah Subarsky, N. Eldred Bingham, Benjamin C. Gruenberg, Ellis Haworth, Morris Meister, Hanor A. Webb, Charles W. Reynolds, Edith M. Selberg, Mervin E. Oakes, Louise A. Neale, Philip G. Johnson, Jack Hudspeth, Hubert B. Crouch, Vaden W. Miles, James E. Adell, Robert H. Carleton, Harry H. Williams, Warren P. Everote, Nathan A. Neal, Hubert M. Evans, Glenn O. Blough, J. Darrell Barnard, Martin L. Robertson, Milton O. Pella, Earl R. Glenn, Francis D. Curtis, George G. Mallinson, Richard H. Lampkin, Philip N. Powers, William C. Van Deventer, Katherine E. Hill, Betty Lockwood, Joe Young West, and Clarence M. Pruitt.

Presiding President Ira C. Davis presented each person to the group and asked each one to rise as he called his name. Each person stated his present position.

The annual business meeting then proceeded as follows:

The official minutes of the last business meeting which was held at Atlantic City, March 2, 1947, and were published in the October, 1947, issue of *SCIENCE EDUCATION*, were approved as published.

The report of the Auditing Committee was made for the committee by Hanor A. Webb. The other members of the Committee were Mervin E. Oakes and S. Ralph Powers, Chairman. The report stated that the Treasurer's books had been audited and found to be in balance.

Treasurer Clarence M. Pruitt presented each member with a mimeographed statement showing the financial status of The National Association for Research in Science Teaching. It was moved and seconded that the Treasurer's report be accepted. The motion was carried.

The next order of business was a report on proposed new members. It was moved

and seconded that the names of proposed new members on list one be elected to membership in The National Association for Research in Science Teaching. Data concerning each member on this list had been sent to members more than three months prior to the annual meeting. The motion carried and all persons on this list were declared duly elected.

The report of the Committee on Revision of the Constitution was made by Martin L. Robertson, Chairman. Other members of the Committee were Philip G. Johnson and Nathan A. Neal. A motion that the report be accepted was made by Martin L. Robertson. The motion was seconded by Morris Meister. The motion carried. The proposed new Constitution was read section by section by the Chairman of the Committee, Martin L. Robertson. A number of changes in wording were made in the Constitution, the changes being duly approved upon motion and seconded by the various members present. Only in two major particulars was the Constitution radically changed. The first relates to Article IV concerning the time and place of holding the annual business meeting. A second major change states that new members may be elected by mail vote thirty days before the date of the annual business meeting. The motion carried. A motion was made by Mervin E. Oakes and seconded by Jerome Metzner that Section I of Article II of the By-Laws of the old Constitution be suspended and that names of all persons on List II and List III be elected to membership in The National Association for Research in Science Teaching. The motion carried and the names of persons on Lists II and III were declared duly elected. A motion was then made and seconded that the proposed new Constitution be accepted. The motion carried.

Chairman Ira C. Davis then asked

Morris Meister, President of The National Science Teachers Association, to make a report on that organization. Dr. Meister listed a number of the activities and projects engaging the attention of The National Science Teachers Association. It has more than 4,000 members.

A report of the Editorial Committee was made by Chairman N. Eldred Bingham. Other members of the Committee are Wilbur L. Beauchamp and Charlotte L. Grant. It was moved and seconded that the report be accepted. The motion carried.

The report of the Nominating Committee was made by Chairman Francis D. Curtis. Other members of the Committee were C. L. Thiele and H. Emmett Brown. The report was as follows:

President: Joe Young West.

Vice-President: N. Eldred Bingham.

Secretary-Treasurer: Clarence M. Pruitt.

Executive Committee: Ira C. Davis, Betty Lockwood.

It was moved and seconded that the Secretary be empowered to cast a unanimous ballot for those named by the Nominating Committee. The motion carried.

A motion was made by Clarence M. Pruitt that certain members of The National Association for Research in Science Teaching who had recently retired from active teaching be made Honorary Life Members of The National Association for Research in Science Teaching. The motion was seconded by J. Darrell Barnard. The motion carried.

Members elected to Life Membership: Anna M. Gemmill, Jennie Hall, Myrtle E. Johnson, Frank C. Jean, George C. Wood.

A motion was made by Vaden W. Miles

that the Secretary be empowered to convey to Mrs. Otis W. Caldwell and Mrs. George W. Hunter the sympathy of The National Association for Research in Science Teaching in the passing of their respective husbands, Otis W. Caldwell and George W. Hunter, for many years valued and esteemed members of the association. The motion carried.

A motion was made and seconded that the meeting be adjourned. The motion carried.

At a meeting of the Executive Committee held on Monday, February 23, 1948:

The Executive Committee enthusiastically decided to continue all present committees for the coming year. The Secretary was asked to so notify the chairmen of the various committees.

It was decided to request all persons appearing on the next annual program to prepare a brief summary of their reports.

The American Association of School Administrators will be asked to have a well-known science leader on their annual program next year.

It was moved to ask the U. S. Office of Education if it would be possible for them to furnish The National Association for Research in Science Teaching periodically with a list of research projects underway or completed. It is recommended that the U. S. Office of Education write to all colleges and universities asking them to furnish the U. S. Office of Education with copies of theses completed at their respective institutions.

Respectfully submitted,

CLARENCE M. PRUITT,

Secretary.

REPORT OF THE PUBLICATIONS COMMITTEE

N. E. BINGHAM

The Publications Committee, consisting of Doctors Wilbur L. Beauchamp, Charlotte L. Grant and myself have met twice during the past year. This report covers both meetings.

This Committee believes that it is its function to represent the interests of N.A.R.S.T. in all official articles such as reports and papers presented at meetings of N.A.R.S.T. and which are duly designated

as such in the journal. Consequently the Committee plans to meet within two weeks at which time it will approve for publication, approve for publication subject to changes which the Committee will indicate, or reject for publication the manuscripts which come from the N.A.R.S.T. programs. Manuscripts received after this meeting will probably have to be published in a subsequent issue of SCIENCE EDUCATION. The Committee does not plan to edit these reports and papers as the editing will be done by Dr. Pruitt, Editor of SCIENCE EDUCATION. In cases where the papers are shortened to any considerable extent, the Committee believes it desirable that the author approve the modified manuscript.

There is the question of N.A.R.S.T. sponsoring the publication of particular manuscripts such as syllabi for unusual science courses and the like which are of interest to science teachers. In this connection, the Publications Committee has

recommended and the Executive Committee has approved the publication of one such syllabus, namely, The Northwestern University, "Introduction of Science" Syllabus.

At the 1947 annual meeting of N.A.R.S.T. there was considerable discussion about the desirability of a yearbook. The Committee will welcome any suggestions from members concerning such a publication.

1. Should there be a yearbook other than a special issue of SCIENCE EDUCATION?
2. If there should be a yearbook:
 - (a) What should be its nature?
 - (b) What about the time of publication?
 - (1) Should it be published yearly or when there is something to publish?
 - (2) When should the first one be published?
 - (3) How should such a publication be financed?

NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING FINANCIAL REPORT

February 22, 1948

RECEIPTS

Balance on deposit	\$1,101.07
Science Education stock	500.00
Membership Fees	380.00
Total.....	\$1,981.07

EXPENDITURES

Secretary expenses	\$50.00
Chicago Executive Committee (Stenographic and Typing)	9.75
Earl R. Glenn (Railroad Fare to Chicago, May 17)	34.50
Earl R. Glenn (Typing during year as N.A.R.S.T. President plus \$9.00 for postage)	49.00
Clarence M. Pruitt—Treasurer's Bond	10.00
Science Education (72 subscriptions)	180.00
Mayer Printing Company (3,000 letterheads and 3,000 envelopes)	39.00
G. P. Cahoon (Transportation costs to Cooperative Meeting Chicago October 4-5)	32.21
Bank charges	6.31
Total.....	\$410.77
Assets.....	\$1,570.34

Respectfully submitted,
CLARENCE M. PRUITT,
Secretary-Treasurer.

CONSTITUTION AND BY-LAWS OF THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

CONSTITUTION

ARTICLE I

Name

This organization shall be known as The National Association for Research in Science Teaching.

ARTICLE II

Purpose

The purpose of this Association shall be to promote research in science education and to disseminate the findings of this research in such ways as to improve science education.

ARTICLE III

Officers—Rotation and Tenure

Section 1. The officers shall be a President, a Vice-President, and a Secretary-Treasurer, who, together with the retiring President and one Member-at-Large, shall constitute an Executive Committee. All new officers shall be elected annually by the Association at its annual business meeting.

Section 2. No member shall be eligible to election as President until he shall have served one term as a member of the Executive Committee.

Section 3. The President, Vice-President, and Member-at-Large shall not be eligible for re-election to the same office until after the lapse of two years. The Secretary-Treasurer shall be eligible for re-election for an indefinite period.

ARTICLE IV

Meetings

The Executive Committee shall arrange the time and place of the annual meeting and of additional meetings. The business meeting of the Association, however, shall be held at the time and place of the annual meeting.

ARTICLE V

Membership

This Association shall have unlimited membership among those who by training and work have shown their interest in the improvement of science teaching in any field, and who have contributed philosophical or statistical studies or applications of research, which contributions shall have been made accessible through suitable publication or report. Individuals who have contributed outstanding service to the advancement of science in education may, upon recommendation of the Executive Committee and approval of the membership, be admitted to the Association.

ARTICLE VI

Publication

This Association shall publish, or cause to be published, for the benefit of its members and others, selected articles, reviews or reports of research which are in harmony with the purposes of the Association.

ARTICLE VII

Dues

The dues of this Association shall be five dollars per year, payable at the time of the annual meeting.

ARTICLE VIII

Life Members

Any regular member of the Association shall be eligible to election as a life member. The dues for life membership shall be one hundred dollars.

ARTICLE IX

Amendments

This constitution may be amended by a two-thirds vote of the members present at the annual business meeting, provided printed notice of the proposed amendment has been sent to the members at least a month prior to such annual meeting.

BY-LAWS

ARTICLE I

Officers and Committees

Section 1. The President shall be Chairman of the Executive Committee and shall preside at all business meetings and shall be ex-officio member of all committees.

Section 2. The Vice-President shall preside at all business meetings in the absence of the President.

Section 3. The Secretary-Treasurer shall keep all the minutes and have custody of all books and papers relating to the Association; notify members of annual dues; collect the dues and issue receipts; issue notices of all meetings; and notify candidates of election.

Section 4. The Secretary-Treasurer shall keep an account of the receipts and expenditures, and shall pay bills only upon written order of the President. He shall make a report to the Association at the annual meeting, which may direct that the report be published.

Section 5. The Executive Committee shall conduct the usual business of the Association, and shall publish reports of officers and standing committees at their discretion.

Section 6. The President, with the approval of the Executive Committee, shall appoint all standing and special committees. Standing committees shall include the Publications Committee, the Program Committee, the Audit Committee, and the Nominations Committee.

ARTICLE II

Membership

Section 1. The names and addresses, together with an abstract of the qualifying activities and research of proposed new members shall be sent to the Secretary in writing. From these names the Executive Committee shall nominate persons for election to membership. These nominations, together with a summary of the qualifying data in each case and a ballot shall be submitted to the members of the Association at least three months prior to the annual business meeting. Two-thirds of the votes received by mail 30 days before the annual business meeting shall constitute election to membership. The new members shall be received into the Association at the annual business meeting.

Section 2. All resignations shall be sent to the Secretary in writing.

ARTICLE III

Dues

Section 1. Any member failing to pay dues within six months after being duly notified shall forfeit the right to membership. Any former member may be considered for re-election without prejudice.

ARTICLE IV

Election of Officers

Section 1. At or before the regular annual business meeting, the President shall appoint a committee of three to nominate officers, including members of the Executive Committee, for the ensuing year; this list, together with names suggested from the floor, shall be presented at a regular session and voted upon by ballot.

ARTICLE V

Amendments

Section 1. The By-Laws may be amended only at the annual business meeting after 30 days notice has been given to the members. No amendment shall be adopted except by a two-thirds vote of those present.

RECENTLY ELECTED MEMBERS OF THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

LIST I

Leona M. Sundquist, 445 16th Street, Bellingham, Washington.
 Philip N. Powers, 2703 Lee Boulevard, Arlington, Virginia.
 Samuel Milton Nabrit, Atlanta University, Atlanta, Georgia.
 Ralph W. Lefler, 115 West Stadium Avenue, West Lafayette, Indiana.
 Kenneth Eugene Anderson, Campus School, Iowa State Teachers College, Cedar Falls, Iowa.
 Robert Adrian Bullington, MacMurray College, Jacksonville, Illinois.
 H. J. Edward Ahrens, 3717 Livingston Drive, Long Beach 3, California.
 Maurice R. Ahrens, 414-14th Street, Denver 3, Colorado.
 Edward K. Weaver, State Teachers College, Montgomery, Alabama.
 Zachariah Subarsky, 5415 Netherland Avenue, Riverdale 63, New York.
 Milton O. Pella, University High School, University of Wisconsin, Madison, Wisconsin.
 Arthur L. Mills, 1122 Wisconsin Street, Lake Geneva, Wisconsin.
 Hubert Branch Crouch, Tennessee A. and I. State College, Nashville 8, Tennessee.
 Ruth M. Lippenberger, 227 So. 13th East, Salt Lake City, Utah.
 Harold E. Reynard, Ohio State University, University School, Columbus, Ohio.

William B. Reiner, 81 Ocean Parkway, Brooklyn 18, New York.
 Alden Herman Struble, 4940 Hurst Terrace, N.W., Washington 16, D. C.
 Alfred D. Beck, Room 932—Board of Education, 110 Livingston Street, Brooklyn, New York.
 Richard Ralph Armacost, Syracuse University, Syracuse, New York.
 Charlotte Virginia Meeting, 404 West 116 Street, New York 27, New York.
 Abraham Raskin, 355 East 187th Street, New York 57, New York.
 George J. Free, State College, Pennsylvania.
 Venonah Sullivan, 4212 Edgewater Place, Seattle 2, Washington.
 James Richard Irving, 690 Lee Street, Des Plaines, Illinois.
 Gordon Mork, Bemidji State Teachers College, Bemidji, Minnesota.
 Mary Alice Burmester, 243 Kensington Road, East Lansing, Michigan.
 F. L. Grove, 408½ 11th Street S., St. Cloud, Minnesota.
 Raymond Lee Walter, 11 Wentworth Street, Plymouth, New Hampshire.
 William A. Porter, 2205 Vermilion Road, Minneapolis, Minnesota.
 George Griesen Mallinson, Iowa State Teachers College, Cedar Falls, Iowa.
 Miss Archie Jeter MacLean, 3057 Lorain Road, San Gabriel, California.

Vernon S. Culp, 837 Berwin Street, Akron 10, Ohio.
 John Gammons Read, 12 Poplar Street, Providence 6, Rhode Island.
 John Murwyn Mason, 607 Cherry Lane, East Lansing, Michigan.
 Frederick Albertson Rantz, 13001-42nd N.E., Seattle 55, Washington.
 Thomas P. Dooley, Prairie View A. and M. College, Prairie View, Texas.
 Grace C. Maddux, 1844 Nela Avenue, E. Cleveland 12, Ohio.

LIST II

Waldo Willie Emerson Blanchet, The Fort Valley State College, Fort Valley, Georgia.
 Richard H. Jordan, Department of Geography and Geology, Florida State University, Tallahassee, Florida.
 Mildred Einzig, 595 E. 105 Street, Cleveland 8, Ohio.
 Clifford G. McCollum, University of Missouri, Columbia, Missouri.
 Charles Edward Montgomery, 512 College Avenue, DeKalb, Illinois.
 Woodrow W. Wyatt, 212 Education, University of Missouri, Columbia, Missouri.
 Edward Zodiag Friedenberg, 5835 Kimbark, Chicago 37, Illinois.
 Victor E. Schmidt, Farnow Hall, Cornell University, Ithaca, New York.
 Maurice Carl Fleming, Tony Tank Road, Salisbury, Maryland.

F. Atherton Reidel, Physical Science Department, Oklahoma A. and M. College, Stillwater, Oklahoma.

LIST III

Louise Adelaide Neal, Colorado State College of Education, Greeley, Colorado.
 Herbert S. Zim, 64 Reid Avenue, Port Washington, New York.
 Julian Greenlee, 563 W. 113th Street, New York 25, New York.
 Keith C. Johnson, Woodrow Wilson High School, Nebraska Avenue and Chesapeake Street, N.W., Washington 16, D. C.
 W. Edgar Martin, Assistant Specialist in Biology, U. S. Office of Education, Washington, D. C.
 Harley F. Glidden, Snyder Hall, Colorado State College of Education, Greeley, Colorado.
 Leroy Spore, Mt. San Antonio College, Pomona, California.
 Percy Warren, Head Department of Natural Sciences, Madison College, Harrisonburg, Virginia.
 John Wells, Madison College, Harrisonburg, Virginia.
 Cecil DeLaBarre, Professor of Biology, Virginia Polytechnic Institute, Blacksburg, Virginia.
 Frederick L. Fitzpatrick, Professor of Natural Sciences, Teachers College, Columbia University, 525 West 120 Street, New York.
 David Blick, Associate Professor of Chemistry, University of Connecticut, Storrs, Connecticut.

RECENT DEATHS

HOMER WILLIAMSON LE SOURD

Homer Williamson LeSourd, retired head of the science department of the Milton Academy (Massachusetts), died on March 15th. Mr. LeSourd was born at Bellefontaine, Ohio, July 27, 1875. He received an A.B. degree from Ohio Wesleyan College (Delaware) in 1898, and an M.A. degree from Harvard University in 1901. He served as assistant in science (1897-98) at Ohio Wesleyan College, assistant in physics (1901-02) and lecturer (1929-25), Graduate School of Education, Harvard University; instructor (1902-03), Pomfret School (Connecticut), and head of science department, Milton Academy (1903-45). He served as secretary (1908), vice-president (1914), and president (1917) of the Eastern Association of Physics Teachers. He was a Fellow in the American Association for the

Advancement of Science and was at one time on the editorial staffs of *SCIENCE EDUCATION* and *School Science and Mathematics*. For many years he was a member of the National Association for Research in Science Teaching.

CHARLES ELWOOD DULL

Charles Elwood Dull died December 19 at the age of 69. Many American science teachers and readers of *SCIENCE EDUCATION* remember Mr. Dull as the well-known author of the widely used and popular textbooks *Modern Chemistry*, *Modern Physics*, and *Safety First and Last*. He was supervisor of science in junior and senior high schools in the Newark, New Jersey, schools from 1935 until his retirement in 1944. His teaching experience included Cazenovia Seminary (New York), Johnstown (Pennsylvania), Orange (New Jersey), and Newark (New Jersey) 1917-1944.

NATIONAL COUNCIL OF ELEMENTARY SCIENCE OFFICERS ELECTED AT ATLANTIC CITY

President: Rose Lammel, Teachers College, Columbia University, New York, New York.

Vice-President: Glenn O. Blough, U. S. Office of Education, Washington, D. C.

Secretary-Treasurer: Louise A. Neal, Colorado College of Education, Greeley, Colorado.

Board of Directors: Katherine E. Hill (1948-1953), Wheelock College, Boston,

Massachusetts; Clarence M. Pruitt (1948-1952), Oklahoma A. and M. College, Stillwater, Oklahoma; Florence G. Billig (1948-1951), Wayne University, Detroit, Michigan; Ruth G. Scribner (1948-1950), Minneapolis Public Schools, Minneapolis, Minnesota; Gerald S. Craig (1948-1949), Teachers College, Columbia University, New York, N. Y.

NATIONAL URBAN RAT CONTROL CAMPAIGN

RATS are more numerous than people in the United States. They multiply fast: uncontrolled, one pair could produce 350,000,000 rats in three years. Rats eat practically anything. They damage many more articles by gnawing and pollution. Rats menace your health. They spread deadly plague, typhus fever, tularemia, trichinosis, and other dread diseases. Rats cost us more than two billion dollars a year. Rats destroy or contaminate over two hundred million bushels of grain. That is almost half as much grain as the United States plans to send to hungry Europe this year.

Under the leadership of the U. S. Department of Interior an Urban Rat Control Program is now started. A number of civic groups and industrial representatives have formed the National Committee for Rat Control. It is headed by Mr. Hamilton M. Warren, Vice-President of National Carbon Company. Its membership includes many executives from industries and business pledged to save food by controlling rats—millers, bakers, restaurant owners, distillers, meat handlers, confectioners, pesticide manufacturers, and others.

February, 1948, is the month of preparation. Working together, The National Committee for Rat Control and the Fish and Wildlife Service are preparing the materials to help localities fight rats. There will be posters and pamphlets, sample news stories and publicity, photographs and contests, technical information of all types. The information will be available to answer the questions of local citizens who are ready

to fight rats. Fish and Wildlife Service is adding rat-control specialists to its staff for local communities.

In March, 1948, demonstration rat-control campaigns were begun in 26 selected key cities, one in each of the 26 districts where rat-control specialists are available. Clean-up of garbage and refuse, and rat-proofing of premises will be given major attention. Organization of effective city inspections, and enforcement of anti-rat ordinances will also be stressed. Actual rat-killing will be done by trapping, poisoning, and gassing: the city will do the work on public property, while private citizens, either on their own or through commercial exterminators, will handle the job on private property.

The best advice and assistance will be made available to these pioneering communities. The National Committee for Rat Control and the Fish and Wildlife Service will provide expert technicians, cooperation of national citizen groups, technical information, and publicity aid. National magazines, press representatives, radio and newsreel men will be invited to watch these demonstrations.

Delegations of citizens from nearby cities in the district will also visit the demonstration cities to watch the model campaign in action. Science teachers and their classes in many instances may be able to observe the demonstrations or at least to cooperate when aid from the National Committee and the Wildlife Service shifts to their city. They, too, can start the campaign at home.

PAUL E. BLACKWOOD

ABSTRACTS

WITTY, PAUL. "An Analysis of the Personality Traits of the Effective Teacher." *Journal of Educational Research* 40:662-671. May, 1947.

In response to a radio broadcasting program (Quiz Kids) several thousand letters were received by children on the topic *The Teacher Who Has Helped Me Most*. Twelve thousand of these were carefully analyzed, an equal number (4000) from three age groups: up to 9, 9 to 14, 14 and up. Order of traits mentioned in the 12,000 letters. 1. Cooperative, democratic attitude, 2. Kindliness and consideration of the individual, 3. Patience, 4. Wide interests, 5. Personal appearance and pleasing manner, 6. Fairness and impartiality, 7. Sense of humor, 8. Good disposition and consistent behavior, 9. Interest in pupils' problems, 10. Flexibility, 11. Use of recognition and praise, and 12. Unusual proficiency in teaching a subject.

SYMONDS, PERCIVAL M. "Personality of the Teacher." *Journal of Educational Research* 40:652-653-661. May, 1947.

The author summarizes the results of investigations that have to do with the personality of teachers. These include: importance of teaching personality, relation of education to its teachers, qualifications of a good teacher, teacher needs, problems faced by the teachers, assessment of teacher personality, development of personality, the supervisor and the teacher, helping teachers with adjustment problems, how teachers meet personal problems, value of the mental hygiene course in teacher adjustment, and need for teacher counseling.

Six factors are proposed as being essential for any individual who is to succeed as a teacher:

1. Every teacher should *like* teaching, and through her work should attain personal goals and satisfaction. A good teacher does not take up teaching for superficial reasons under economic pressure, or in order to escape from some less desirable form of work.

2. A good teacher should be personally *secure* and should have *self respect, dignity and courage*, as opposed to feelings of inferiority and inadequacy. The personally insecure teacher has difficulty with discipline and either becomes inept and ineffective or must maintain her status by bluff and swagger.

3. A good teacher must be able to *identify* herself with children. She must have social awareness, the capacity to enter into the feeling and interests of others, and to understand the motives and conflicts of others.

4. The competent teacher is *emotionally stable*. She is able to *accept* the aggression of boys and girls and their laziness, carelessness, slowness, and stupidity as well as their brightness, industry and efficiency. She should be able to accept competition with her colleagues and the demands and restrictions imposed by the community.

5. The effective teacher should be *free from anxiety*. She should be free to experiment and to try out innovations in her teaching in the class-

room. She should feel free to permit a certain amount of disorder in her classroom without fearing censoring from her superiors.

6. A good teacher is not too *self-centered*, or *selfish*, but is able to give herself freely and without reserve to the needs and interests of her pupils.

HOOK, J. N. "Each Day You Sit for Your Portrait." *The Clearing House*. 222:299-302. January, 1948.

Teachers facing their classes every school day are having their portraits painted whether they will it or not, is the thesis of this challenging article. The kind of a portrait painted is up to the teacher concerned. Two quite different teachers are painted in this article.

CROSS, E. A. "To Make Teaching A Profession." *The Educational Forum* 12:25-29. November, 1947.

Teachers like to think of their occupation as a profession. Actually it is still far below the requirements set up by the professions of law, medicine, and engineering. College teaching approaches, but has not yet reached, the professional status.

If teaching is to become a profession four things must be brought about.

1. Prospective teachers must be chosen from those only who have the personal qualities that are characteristic of good teachers.

2. They must also have the character, culture, and education that accompany those personal traits.

3. They must have the intention to make teaching a permanent occupation.

4. To induce such people to become professional teachers they must have the assurance of an income sufficient to enable them to live on an economic and social level comparable with that of other professional men and women in their community.

The beginning of the transformation will have to be made at the economic level. It will be necessary to pay good teachers salaries that would now seem fantastic to school boards and the public. Professor Cross proposes the organization of an American Teachers Association (similar to the American Medical Association). He does not believe the N.E.A. could ever serve the purpose he has in mind. He states that the dominant purpose of the N.E.A. has never been to make a profession of teaching. It looks at the school system through the eyes of the executive. Traditionally it has been mainly interested in the organization of an educational system, in buildings, in equipment, in accounting, in statistics, in "selling the schools to the public".

Salary scales in the proposed American Teachers Association should be on three levels: Apprentice Teachers, Professional Teachers, and Master Teachers. He proposes a salary scale of 2400 to 4500 dollars for Professional Teachers. Master Teachers salaries would start at 5000 dollars.

Symposium. "Experiences with Physics Courses in General Education." *American Journal of Physics* 15:484-488. November-December, 1947.

The article summarized the proceedings of the Round Table, Colloquium of College Physicists, State University of Iowa, June 13, 1947. Discussion at this meeting indicated that current emphasis on general education, as contrasted with specialized training, is rather fundamental and is here to stay. Experiences with seven general courses in physics for the nonscience students were described: Lawrence College, Kalamazoo College, Beloit College, Wabash College, Swarthmore College, State University of Iowa, and Colgate University. Recommendations included:

1. That there be established in our colleges special physics or physical science courses for students in general education;
2. That courses be so organized and so taught they they can: (a) Be applicable to our common life in both a particular and a broad sense,
- (b) Give the student an opportunity to think independently and to cultivate confidence in his ability to do so,
- (c) Give the student a distinct awareness of the possibility of his creativity at his own level of attainment,
3. That such a special course should not be standardized, but that each such course, should be adjusted to the curriculum in its own college,
4. That the colloquium for 1948 organize a round table that will discuss the effectiveness of methods of teaching and testing used in these special courses.

VALLANCE, THEODORE R. A Comparison of Essay and Objective Examinations as Learning Experiences. *Journal of Educational Research*. 41:279-288. December, 1947.

The validity of the three following hypotheses were substantially refuted:

1. Apart from any differences in preparation for the two types of test, the essay testing situation *per se* is superior as a learning experience to the objective testing situation, as measured by retention over a given period of time of the subject-matter covered by the tests.

2. Apart from any differences in the actual examinations, the methods of preparing for the essay examination are superior as learning procedures to those used in preparing for objective examinations, as measured by retention of the subject-matter over a given period of time.

3. The essay type of examination together with any peculiarities in preparation, provides a learning situation superior to that offered by the objective type, as measured by retention of the subject-matter over a given period of time.

SCATES, DOUGLAS E. Fifty Years of Objective Measurement and Research in Education. *Journal of Educational Research*. 41:241-264. December, 1947.

In 1897 Joseph Mayer Rice published two articles representing some sixteen months of study, entitled "The Futility of the Spelling Grind." This work is usually taken as the beginning of the

modern movement for the objective study of education.

The first decade (1897-1906) was one of incubation of the testing idea. The second decade (1907-1916) included the actual appearance of standardized tests and the fight to get them accepted. It was an important promotion period. The third decade (1917-1926) was a period of triumph and rapid expansion of the testing movement. The decade 1927-1936 was one of maturing in a number of ways—measurement took on new forms. The second war period (1937-1946) placed emphasis upon validity and better tests. The paper is rather completely documented. Progress in educational research begins with the use of objective tests and further progress will depend upon refinement in evaluation techniques.

RUSH, R. I. Determining and Implementing Objectives for a General Course in Physical Sciences. *The Journal of General Education* 2:138-143. January, 1948.

Objectives of a general course in the physical sciences can be determined in a systematic, logical way. The author states four criteria by which each objective may be tested. Suggested means of determining particular needs are listed.

As an illustration the author lists one problem: to determine what factors are involved in stopping an automobile and how are these factors related? Then follows a list of activities to engage in solving the problem and resources needed to solve the problem: information, skills, habits, attitudes, and beliefs, and interests and concerns.

SYMPHOSIUM. Conference on Philosophy of Education. *Teachers College Record*. 49:263-290. January, 1948.

This symposium is a report of the meetings held November 10, 1947 on the occasion of the presentation of the William H. Kilpatrick Award for Distinguished Service in Philosophy of Education to Dr. Boyd H. Bode of Ohio State University.

Papers include: *Introductory Statement* by R. Bruce Raup; *A Memorable Occasion* by George S. Counts; *Boyd H. Bode: An Appreciation* by John Dewey; *A Great Teacher and Colleague* by Gordon Hullfish; *Bode's Philosophic Position* by William Heard Kilpatrick; *Education for Freedom* by Boyd H. Bode. *Bode in American Philosophy of Education* by John L. Childs; and *Questions Concerning Bode's Position* by Kenneth D. Benne.

SYMPHOSIUM. A Progress Report of the Horace Mann-Lincoln Institute of School Experimentation. *Teachers College Record*. 49:305-362. February, 1948.

Contributors to this symposium include: Rose Lammel, Hubert M. Evans, Marcella R. Lawler, Hollis L. Caswell, Florence B. Stratmeyer, Ruth Cunningham, Glenn Hass, Arthur T. Jersild, Gordon N. Mackenzie, Alice M. Miel, Chandos Reid, and Kenneth D. Beene.

Major phases of the report are: Conditions Influencing Curriculum Research, Child Develop-

ment and the Curriculum, The Social-Cultural Context of the School Program, Developing Curriculum Plans, Shortage Areas in Current Curriculum Experimentation (Health, Group Behavior with Boys and Girls, Cooperative Planning), Cooperative Research in Curriculum Development, and a Forward Look.

BRESLICH, E. R. Curriculum Trends in High School Mathematics. *The Mathematics Teacher*. 41:60-69. February, 1948.

Curriculum trends in high school mathematics are unmistakably away from a single mathematical curriculum for all high school students toward one consisting of two or more plans, each designed to meet the needs of a particular group. One plan retains the traditional sequential courses—for future scientists, engineers, research workers, and others. The second plan is general mathematics for grade nine and comprises the basic concepts of mathematics.

SNADER, DANIEL W. The Professional Needs of Secondary School Teachers of Mathematics. *The Mathematics Teacher*. 41:51-59. February, 1948.

The professional needs of teachers of secondary mathematics include: (1) Philosophy, (2) A rapid review of secondary school mathematics, (3) The use of audio-visual aids and mathematical aids in vitalizing the study of mathematics, (4) The need for classroom experimentation, (5) Special courses, (6) Modernizing Junior High School mathematics, (7) The adaptation of instruction to pupils of varying abilities, (8) College teachers of mathematics who know something about secondary mathematics and education, (9) Counsel-

ing service for teachers of mathematics, and (10) In-service training of teachers of mathematics.

OEHSER, PAUL H. George Brown Goode. (1851-1896). *Scientific Monthly*. 47:195-205. March, 1948.

Goode was born at New Albany, Indiana, on February 13, 1851, of sturdy American stock. He spent his early youth and received his education in the east. He studied under Louis Agassiz. He was one of the early leaders in museum organization and helped develop the techniques best to follow in collecting and museum arrangement. In 1887 Goode was made assistant secretary of the Smithsonian Institution. Scientific endeavor in the form of lectures, papers, indexes, and bibliographies consumed much of his time in addition to his museum work. He knew as well as anyone the drudgery connected with the compilation of indexes and bibliographies, yet he realized that they are the indispensable tools of the research worker and that there is an obligation laid upon every generation of scientists and scholars to provide works of this character.

He helped to organize the Sons of the American Revolution and the Daughters of the American Revolution. He was one of the founders in 1888 of the National Geographic Society. He died at the age of forty-five years. Those interested in genealogy will be interested to know he wrote a very complete record of the Goode family of Virginia. This article will form part of a chapter in the author's book *A Biographical History of the Smithsonian Institution*, to be published by Henry Schuman, Inc., New York, in "The Life of Science Library." Photographs accompany the article and reveal the mode of dress and transportation of that time.

BOOK REVIEWS

VISHER, STEPHEN SARGENT. *Scientists Starred 1903-1943 in American Men of Science*. Baltimore: The Johns Hopkins Press, 1947. 556 p. \$4.50.

This volume concerns 2607 scientists who, by secret vote of their peers, were judged especially outstanding. Their biographical sketches in *American Men of Science* are marked by an asterisk. One thousand were starred in 1903 and about 250 additional in each of the following six editions.

In this book their educational and other background influences are considered for each of the groups, which are listed by departments of science, and by place of birth, collegiate and more advanced academic training, and place of employment. The starred alumni of each of the colleges and universities are listed by departments of science and by year of graduation. Other lists include these especially effective as teachers, the starred women, starred fathers and sons, starred brothers and (for the 1000 starred in 1903), their order of eminence in their chosen field.

So many interesting conclusions are presented that only a relative few can be presented in a review. The number of starred scientists in each of the twelve sciences: Anthropology 54, Anatomy 66, Physiology 115, Psychology 132, Astronomy 137, Pathology 170, Mathematics 211, Botany 257, Geology 263, Zoology 377, Physics 383, and Chemistry 468. The median age at starring was about 43 years, being lowest in Astronomy (40.5 years) and highest in botany and pathology (48 years). Of the 1145 known dead by the end of 1946, the median age of death was 72, lowest in physiology (66.2 years) and highest in astronomy and geology (73.5 years). About 84 percent of the starred scientists were born in the United States. The East North Central led in the number of starred scientists, followed by the Middle Atlantic region then the New England region. In proportion to size of population, New England ranks first, followed by the West North Central region. Among the states New York ranks first (362), Massachusetts second (267) and Ohio third (261).

The rank of the nine most productive institu-

tions (not in order) in the collegiate training of starred scientists are Harvard, Yale, Chicago, Cornell, Michigan, Johns Hopkins, California, Columbia, and Princeton.

The four months of greatest yield of starred scientists (by birth) are in order March, January, December, and February. This group also lived to an average greater length of life.

About half of the scientists have had relatives who have been scientists. Qualities considered by Starred Scientists as significant for scientific workers include: perseverance, mental alertness, curiosity, initiative, enthusiasm, critical insight, exceptional honesty, exceptional energy, and superior memory.

A major contribution of the investigation is the expressed opinion by scientists that superior teachers play a large role. High school and other pre-college teachers are seen to be much more influential than has been assumed often. The great significance of exceptionally stimulating college teachers is demonstrated. Many of the scientists decided upon a career in science early in life. Encouragement was a great influence in the lives of these scientists. They recommend more physical science (98 per cent), more biological science (92 per cent), foreign travel (83 per cent), more earth science (77 per cent), more humanities (74 per cent), and more social science (68 per cent).

Altogether this is a most monumental work and is of great significance to science teachers everywhere. Both the author and the publishers are to be congratulated upon the publication of a work of such great significance. It is difficult for the reviewer to comprehend the perseverance and amount of effort involved. Even proof-reading the galley was a tremendous task! There are 117 illustrations, mostly graphs, and in addition, a total of 206 tables.

C. M. P.

FENTON, CARROLL LANE AND KAMBLY, PAUL E. *Basic Biology for High Schools*. New York: The Macmillan Company, 1947. 726 p. \$3.24.

Both the authors and the publishers have a right to be proud of this excellent biology. To the reviewer, probably the most distinguishing characteristic of this book is its lively literary style and the avoidance of needless technicality. Important matters are emphasized, not confusing details. Excellent illustrations enhance the value and appeal of the textual material. Dr. Fenton is a well-known writer of popular biology and Dr. Kambly is an active classroom teacher of biology and methods of science teaching. They have combined together to make an unusually fine textbook team.

Fundamental facts, principles, and problems in the science of living have been selected. Chapters and units have been so organized as help students to employ the scientific method and develop habits basic to scientific attitudes. Each chapter has such study aids as the main facts of this chapter, questions testing knowledge of the chapter, use of

the scientific method, discussion questions, projects and activities, and suggested readings.

C. M. P.

BROWN, HOWARD E. *The Earth*. Oklahoma City: Times-Journal Publishing Company, 1947. 449 p. \$1.88.

This is a textbook intended for a high school course in Geology but would be equally suitable for the geology phases of the physical science survey course. In fact there are very few, if any, more suitable geology texts now available for such courses. Elementary science, geography, and general science teachers will find the book an excellent, authoritative supplementary reference.

The text is divided into three major units: Geological Processes Acting on the Earth, The Earth's History, and The Earth's Mineral Wealth.

Each chapter has a summary and a list of review questions. Each chapter is introduced by an appropriate poetic quotation. The textual material is written in a most readable literary style with technical vocabulary reduced to a minimum. Numerous pertinent photographs and illustrations (many by the author) supplement the textual material. Undoubtedly the book is deserving of a much wider usage than it now enjoys. The author is to be commended for an excellent text.

C. M. P.

JAFFE, BERNARD. *New World of Chemistry*. New York: Silver Burdett Company, 1947. 700 p. \$2.88.

Jaffe will be remembered for his ability to popularize sciences in his *Crucibles, Men of Science in America*, and *Outposts of Science*. This chemistry text doubtless is one of the outstanding texts for the high school and junior college level. The text has been appreciated both in its earlier form of fifteen years ago and in the present revision. Evidently the changes have been very real and abundant—a state of affairs not always to be observed in so-called revisions. The author has evidently carefully scanned the recent literature of scientific achievements and newer fundamental findings. To mention only a few—one finds references to all the more understandable atomic energy findings, the four added trans-uranium elements, penicillin, powder metallurgy, aerosol insecticides, atabrine, and the new synthetics and alloys.

The science teacher will be pleased to find Jaffe's knowledge of the history of science well and interestingly integrated with the factual subject matter; abundant use of the scientific point of view and method; the recent trend to make much use of the electron theory and a good balance between theory and the applications.

The text reads very comfortably and holds interest. It is sound scientifically, pedagogically and does not ignore sociological implications.

The illustrations are abundant, well chosen, and should serve their purpose.

F. A. R.

HOGG, JOHN C., ALLEY, OTIS E., AND BICKEL, CHARLES L. *Chemistry, A Course for High Schools*. New York: D. Van Nostrand Company, Inc., 1948. 555 p. \$2.88.

This second edition of *Chemistry, A Course for High Schools* by three well-known science teachers has been revised to meet the new emphasis upon atomic structure and atomic energy, for within one month of the publication of the first edition in 1945 came the atomic bomb. The authors have also taken advantage of the second edition to bring the book up to date in other respects, namely, regarding the new elements, the new drugs and detergents. The second edition begins with the same challenging preface to teacher and student as the earlier edition, but the six units have been organized this time under definite subject fields; otherwise the text is the same as the first edition. This is such a good chemistry textbook that the reviewer hesitates to make this one adverse criticism, but the study of carbon is interrupted to study the gas laws. A better organization would be to let these laws precede the chapter "Volume Calculations." The high school teacher of chemistry will welcome this text for a course in chemistry for his students.

G. O.

CALDWELL, Cy. *Henry Ford*. New York: Julian Messner, Inc., 1947. 246 p. \$2.75.

Boys and girls of today have their Horatio Alger stories of men and women who rose from poverty and made good as surely as their parents did. The Ford family was an early family in Ireland. Ford was Irish. His father William came to this country, bought land and made his living on the farm. Young Henry, born here, loved the farm and rural life and later owned many acres of land, but he was convinced machines were needed to make farm work more easy, attractive, and profitable. He was a mechanical genius and at the age of seventeen he went to Detroit to work and learn about machines, metals, and tools. These were to become a part of his environment for the rest of his life. He did not smoke, drink, or chew and always held to strict ideas of conduct, and he expected those who worked for him to do the same.

Henry Ford lived to be eighty-four years of age; a full, complete, useful and happy life. The car which he manufactured and sold at such low cost was and is today one of the greatest achievements of our day. At thirty-three years of age he became a friend of Edison and often the two spent their vacations with Firestone and the naturalist John Burroughs.

Will there be more Henry Fords and Edisons? Surely atomic energy is a wide open field, now challenging our best scientific minds to use it for peaceful and commercial purposes to the betterment of all mankind.

This book makes excellent reading for all adults, and high school boys and girls will learn and profit from reading about the son of Irish immigrants who made good in the freedom-loving

country, America. High school teachers will do well to see this is on their bibliography of reading material or post the name of the book and author on the bulletin board. High school students would read far more and better books if properly guided and directed in their reading.

F. M. D.

TELLER, JAMES DAVID. *Louis Agassiz, Scientist and Teacher*. Graduate School Studies, Education Series, No. 2. Columbus, Ohio: The Ohio State University Press, 1947. 145 p.

One hundred years have now passed since Agassiz came to this country from Switzerland. On the centennial of Agassiz's coming to America it is well to pause and review his life, and the effect that his personality and vigorous method of attacking the unknown had on the development of teaching and research in America. This, the author has done charmingly and with a sensitive touch.

Parents and youth of today should take notice and ponder how many boys of today of ten years of age have mastered the fundamentals and then for four years devoted themselves to nine hours each day of Latin, Greek, Italian, ancient geography and modern geography and other studies as Agassiz did; or at the age of twenty-three to be Doctor of Philosophy and Doctor of Medicine and to have written a quarto volume on the fishes of Brazil, have traveled on foot all over southern Germany, to Vienna, and in the Alps, know every animal, living and fossil, in the museums of Munich, Stuttgart, Tubingen, Erlangen, Wurzburg, Carlsruhe, and Frankfort.

In spite of the far-reaching influence of Agassiz on American scientific education, historians of education have yet to discover it. Before beginning this study the author examined twenty textbooks in these fields, and found references to his work in only seven. In some four thousand pages, only about eight are devoted to Agassiz and his students. And seven of these are to be found in a single textbook! Yet these same books devote whole chapters to Pestalozzi and his students who, as far as American secondary and higher education are concerned, had less influence in the introduction of an objective and concrete method of teaching than did Agassiz and his students. "Study nature not books" was his motto. This was the man's whole philosophy, and upon it he built the foundations of the scientific study of zoology, botany, geology, and many of the branches of these subjects as they are taught in America today. He was both an inspiring teacher and research scientist of renown. His was no doubt the scientific method of approach based on a keen intellect, good judgment, and common sense.

It is evident Agassiz combined book and nature in his study for he said, "I was charmed with Aristotle, whose zoology I had read and re-read at intervals of two and three years."

Agassiz enjoyed a great scientific reputation at the age of thirty. In short, the key to

Agassiz's greatness as a naturalist is to be found in the first thirty-three years of his life; the key to his power as a teacher of natural history appears in the last thirty-three years.

David Starr Jordan, Shaler, William James, and other young men and women of the latter part of the nineteenth century came under his great educational and scientific influence. Peattie's evaluation of Agassiz's work is, "that no American scientist ever had as much influence on scientific education as Agassiz . . ." No doubt Agassiz's major claim to greatness as "the first naturalist of his time" must rest upon his researches on the fossil fishes and on glaciers.

This study of the life and work of Agassiz will be greatly appreciated, not only by teachers and students in the field of science, but by the general reader as well.

F. M. D.

RUNE, DAGOBERT D. (Editor). *The Selected Writings of Benjamin Rush*. New York: Philosophical Library. 1947. 433 p. \$5.00.

Benjamin Rush, one of the signers of the Declaration of Independence knew Benjamin Franklin intimately and called him Uncle Ben. Rush was a great physician and naturalist but being a reformer was probably his avocation. He was very much aware of the time in which he lived. He saw great need for improvement in education, medicine, government and expressed himself on miscellaneous things.

While visiting in France, he noted that medicine was so much retarded there over that of our own country or Scotland. The evils of the social state of France were even then apparent. He saw too many who tried to live "upon the sweat of the brow" of others. Even at that early date French women had small mirrors and compacts and painted their faces in public.

Now with men elected to public office so often failing to measure up to what their constituents expect of them as to ability and character, we are not surprised to find even at the time of Rush he advocated a federal university where men would train specifically for government posts and pursue the study of finance, history, political science and diplomacy, government, commerce, economics and other subjects.

In a discussion on old age Rush states, "I met with one woman, a native of Herefordshire in England, who is now in the 100th year of her age, who bore a child at 60, menstruated till 80, and frequently suckled two of her children (though born in succession to each other) at the same time. She had passed the greatest part of her life over a washing-tub."

In the book we learn about Cretins in valleys of Switzerland and Austria who lacked iodine in their food and failed to develop bodies of full stature.

Some eight pages beginning with page 334, are devoted to the effects of ardent spirits upon man. One can find no better discussion on this topic and with driver's licenses being taken away from many

of our young men today because of drunkenness—what he says is just as pertinent in our time as in the time of Benjamin Rush.

He sets up a score card for conduct of physicians and mentions ways in which physicians fall short of the high calling of their profession.

Benjamin Rush was born on December 24, 1745 on his father's farm north of Philadelphia. He received the bachelor's degree from Princeton College before he had reached the age of 15 and in 1768 he was awarded the degree of Doctor of Medicine at the University of Edinburgh.

F. M. D.

McKEEAN, LOUIS W. *Yale Science: The First Hundred Years*. New York: Henry Schuman, Inc., 1947. 82 p. \$2.50.

This is a title in *The Life of Science Library*, one of a series of biographies of key figures of science. This book covers the period 1701 to 1801. During this hundred years there was an active interest in astronomy and Newtonian mechanics as manifested in the lives of Thomas Clap and Ezra Stiles. The instruction in science was bookish and unexperimental, but Ezra Stiles was far more sympathetic with science than most college presidents of his generation. They realized that the College graduate, whether he was to be a clergyman, or a merchant, or a lawyer, needed to know something of natural as well as moral philosophy. Altogether this is a most interesting treatise on the beginnings of science in one of the world's greatest universities, renowned for its great men of science.

E. D.

WHEELER, LYNDE PHELPS, WATERS, EVERETT OYLER, AND DUDLEY, SAMUEL WILLIAM. *The Early Work of Willard Gibbs in Mechanics*. New York: Henry Schuman, 1947. 78 p. \$3.00.

In this treatise is made available for the first time a number of the earliest pieces of Willard Gibbs, world renowned mathematical physicist. It includes his hitherto unpublished Ph.D. thesis and accounts of a patented brake for railway cars and a mechanical governor for steam engines.

E. D.

BRYAN, ROY C. *Seven Rules of Clear Thinking*. Kalamazoo, Michigan: Western State High School, 1947. 78 p. \$1.25.

This unit of work is the outgrowth of efforts to acquaint the pupils of Western State High School with some of the principles of clear thinking. Approximately six weeks of time has been devoted to the unit each time it has been taught to high school juniors in a social science class. Many practical examples of both clear thinking and its opposite are given. The reviewer thinks that Mr. Bryan and his committee have developed an unusually fine unit.

The seven rules of clear thinking are: 1. Prevent your feelings from dictating your thinking; 2. Suspend judgment until you are justified in reaching a conclusion; 3. Strive to identify assumptions; 4. Insist on adequate cross-section

samples; 5. Beware of analogies; 6. Call for evidence of cause-effect relationships; and 7. Organize your thoughts.

C. M. P.

The California Council on Improvement of Instruction. *Better Teaching Through the Use of Current Materials*. Stanford University: Stanford University School of Education, 1947. 24 p.

This report describes an 18-month experiment which was initiated by the California State Department of Education in January 1946. The object was to see how current materials such as monthly and weekly magazines, daily newspapers, pamphlets, and films, etc., could be used effectively in class work and to determine any advantages to participating students, teachers, communities, and the teaching profession itself. Classes included English, social studies, and science. In the science classes, subjective reactions from the pupils as well as objective measurement gave evidence of the interest value of the materials to pupils. Pupil participation in class discussion was greatly increased. Test scores were higher and much more reading was done by the pupils. Values to the student, the teacher, and the community are listed.

C. M. P.

WATSON, ALMA. *Spinneret Children*. Gainesville, Florida: Project in Applied Economics, College of Education, University of Florida, 1947. 51 p. \$0.35.

Spinneret Children is one of a series of science readers designed to help schools serve their communities by teaching about the basic needs of food, clothing, and housing. This book contains material for both teacher and pupil. The first two chapters describe briefly and understandingly the various kinds of synthetic fibers and fabrics.

Science teachers will especially appreciate the playlet "The Test Tube Cinderella," which shows how synthetic fibers fit into our home living today. The playlet would be excellent for the school assembly as portrayed by the science club, the chemistry class, or the home room.

S. M. A.

ANONYMOUS. *Making Health Visible*. Cleveland (8911 Euclid Avenue): Cleveland Health Center, 1947. 24 p. \$0.25.

The Cleveland Health Museum is well-known for its *Wonders of New Life Collection*. This booklet shows pictures and descriptions of many of its exhibits including the famous birth models.

S. M. A.

LIGHT, ISRAEL. *Annotated Bibliography on Atomic Energy*. New York (Teachers College, Columbia University): Bureau of Publications, 1947. 29 p. \$0.35.

Listed in this annotated bibliography are 257 selected references for schools and discussion groups. Included are books, pamphlets, periodicals and newspapers, special series, and documents. Science teachers and others will find this

bibliography most useful. It is not complete and there is some evidence that the author should have consulted a number of additional sources which he apparently did not.

C. M. P.

BARRANTES, EMILIO. *The Purposes of Peruvian Education*, in "Educacion" (Organ of the greater National University of St. Marcos.) Lima, Peru, 1946. 24 p.

This article appears in the first number of the journal sponsored by this important Peruvian University. It is selected as best representing current educational trends and aspirations of our Latin neighbor. The author, Sr. Barrantes, frankly acknowledges the shortcomings of his people, the shortage also in the schools both as regards equipment and a suitable educational theory and vision. He lets his guards down to the confession "we mimic rather than carefully consider. We build up a paper world not geared to the world about us. We have neither a pedagogic of general validity nor even a clear idea of education."

Dr. Barrantes then enumerates under general and specific aims, some eight points of attack. Under general aims he places first the development of personal aptitudes, the integration of person, the realization of a true culture, a basic culture. He reminds us of the need for the culture for the larger national and restricted, localized units of population. He admits the twofold operation of education by way of the school and by way of living in the world of people and industry. Each has its effect and function. Under specific aims he lists:

1. Education to bring the Indian out of a past full of superstition, complacency and its peculiar vices; not to have him lose his better acquisitions but to gear him to today's world.

2. Preparation to gain mastery over a difficult country, severe mountain conditions, highly variable in climate, inferior transportation and a varied population. It will require a heroic attempt and approach.

3. The training of technicians both manually and intellectually; a general basic education not to be overlooked.

4. Education for unity.

5. Encouragement of a national and historical consciousness.

6. Adoption of democracy and higher social justice.

7. A better environment for morality and a high morale.

8. Education for the necessary social conformity.

F. A. R.

NEW YORK STATE JOINT LEGISLATIVE COMMITTEE ON NUTRITION. *Meals for Millions*. Newburgh, New York (94 Broadway): Thomas C. Desmond, 1947. 213 p. Free.

This is a very unusual legislative report and possibly one of great significance. Numerous specialists have contributed articles to this report. A few examples: Some Obstacles in the

Path Towards an Optimum Diet by Anton J. Carlson; Postwar Problems of the Frozen Food Industry by Clarence Birdseye; Nutrition in the State Health Program by Edward R. Schlesinger. Biology, general science, health and home economics teachers will find this book quite useful.

S. M. A.

HOFF, ARTHUR G. *Secondary Science Teaching*. Philadelphia: The Blakiston Company, 1947. 325 p. \$3.75.

This is a textbook on how to teach science in the junior and senior high school. It would be easy for the reviewer to find fault with this book on methods as he could similarly criticise every other science method book that has been published. None ever seem to quite live up to the ideal. And our methods and emphasis are constantly shifting—almost everytime the course is taught. "Helping the science teacher teach" is the essence of this book as it is or should be in every science methods course. By and large, Dr. Hoff has done a very good job, many parts of the book seem unusually good. In other parts, the reviewer wishes that there had been greater and sometimes a different emphasis. All science teachers, beginning or experienced, will find a lot of helpful and challenging material.

Chapters in the five units are as follows: The Mission of Science in Education: 1. Introduction, 2. The educational values of science, 3. The science teacher's social and professional responsibility; The Content of Science in the Secondary School; 4. The aims and objectives of science teaching, 5 and 6. The science curriculum; The Function of Method in Science Teaching: 7. The learning unit as a method of teaching science in the secondary school, 8. Administration of a unit, 9. Other methods of teaching; Specific Techniques in Teaching Science: 10. Directed study, 11. Conducting the laboratory, 12. Demonstrations and field trips, 13. Evaluation; Supplementary Factors in Teaching: 14. Science clubs, 15. Teaching aids, 16. Science rooms and equipment, and 17. Guidance and the science teacher.

C. M. P.

HORKHEIMER, MARY FOLEY AND DIFFER, JOHN W. *Educator's Guide to Free Films*. Randolph, Wisconsin: Educators Progress Service, 1947. 341 p. \$5.00.

Educator's Guide to Free Films: A cyclopedic, professional service brings to all teachers complete, up-to-date, organized and systematized information on free educational, informational, and entertainment films. Both 16 and 35 mm. silent and sound films are listed. There are 271 titles listed under science, of which 61 titles are new in this edition. In addition, science teachers will find many more suitable films listed under health education and social studies. There is also an extensive list of slide films. Any school or teacher using films as a part of their visual education program should have access to this guide.

C. M. P.

STUTZ, WILHELM. *Goethe in unserm Leben*. Wellsbach and Heidelberg, 1947. 151 p.

For the German reader who enjoys his Goethe, this little booklet will be a welcome addition to his pocket library. It consists of the philosopher's sayings presumably best suited to the needs of people in war-torn Germany and elsewhere. Some selections are rather extensive. It glorifies the German of nobler days and thereby should contribute to better international appreciation.

F. A. R.

CALLAHAN, LUDMILLA I. *Russian-English Technical and Chemical Dictionary*. New York: John Wiley and Sons, 1947. 794 p. \$10.00.

The need for a convenient, easily readable and compact dictionary of scientific and technological terms is well met in this production. Not only are the expected words translated, but there are in addition: lists of word endings, auxiliary and general terms associated in such subject matter, and in the current politically colored regime the related political terms. Industries such as mining will also find the book useful.

The format and typography are excellent.

F. A. R.

MOREHEAD, ALBERT H. AND MOTT-SMITH, GEOFFREY. *Games for Two*. Philadelphia: The John C. Winston Company, 1947. 184 p. \$2.00.

Most of the games described are card games, but included are mill, backgammon, sniff, and liar dice. Complete directions are given.

G. B. K.

KATZ, DAVID. *Psychological Atlas*. New York: Philosophical Library, 1948. 142 p. \$5.00.

Part I has eight chapters which list topics in various phases of psychology. Part II consists of pictures and diagrams numbered sequentially to illustrate specifically the topics covered in Part I. There is a list of photographs of eminent psychologists.

G. B. K.

WARCOLLIER, RENÉ. *Mind to Mind*. New York: Creative Age Press, 1948. 109 p. \$2.50.

Mind to Mind reports two decades of experimentation in psychical research. In this country the experimentation of J. B. Rhine and others has been widely reported and discussed. Much similar work has been carried on in England. This report is based on the author's work in France in which messages in the form of drawings were sent from one person to another, sometimes great distances apart, without known means of communication.

The author believes imagery, imagination, language, and communication, and their relation to the unconscious process of telepathy illustrate many parallels between the laws of psychology and the laws of parapsychology. The author formulates a tentative theory of telepathy in terms of association, motivation, and interpersonal relationships. The author states that telepathy is dependent upon memory and that distance seems to make little difference.

G. B. K.

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GUILD, BRUCE H. *Sprouting Your Wings*. New York: McGraw-Hill Book Company, Inc., 1947. 114 p. \$1.32.

This attractive paper covered book is adapted to a level of 8th and 9th graders. An introduction gives a brief story of the development of flying from the time of Leonardo da Vinci to the present time. Its five main parts have the titles: Let's Fly; Flying Safely; Finding Your Way in the Air; The Hazards of the Weather; The Airplane's Power Plant.

There are 65 illustrations of a type that appeals to young people. The various chapters tell what one has to do to be a pilot, give traffic rules of the air, explain the different types of plane propulsion and has an appendix of discussion questions, a list of visual aids and a bibliography.

W. G. W.

REEDER, FREDERICK M. AND OSBORN, ROBERT C. *Safe for Solo*. New York: Harper and Brothers, 1947. 216 p. \$3.75.

Here is an easy to read, delightfully illustrated book on how to fly. It is one of the very finest books to read for those interested in really understanding flying. The senior writer, Rear Admiral Fred Reeder, U. S. N. (Retired) was in charge of the United States Navy Flight Instruction School. The 262 illustrations which are an integral and delightful part of the text were done by Bob Osborn who is well known for his

Dilbert cartoons (the Navy used Dilbert to show pilots what not to do). The cartoons are intelligent and witty comments on what Reeder explains so clearly in prose.

This is an excellent book for any one interested in flying, or in really wanting to understand flying. It is recommended for the high school book shelf.

G. B. K.

NOVIKOFF, ALEX. *From Head to Foot, Our Bodies and How They Work*. New York: International Publishers Company, Inc., 1946. 96 p. \$2.00.

Dr. Novikoff is a teacher of biology at Brooklyn College. In this book he has demonstrated his keen understanding of the curiosity of the human being about his own body. He has presented clear explanations in a most interesting way. The author starts with the "Why" and "What" in the mind of each of us. The functions of breathing, digestion, circulation of the blood, reproduction, and others, are considered clearly and candidly. Glandular activity and the nervous system are presented in a careful yet attractive manner. The volume is profusely illustrated with labelled drawings, many of which are in color. Nydorf, the artist, shows clarity, originality and freshness of treatment in the illustrations commensurate with the quality of the writing.

While the volume was presumably written for

young people, one wonders if it will not be found equally interesting by those who are more mature. This elementary treatise on physiology could be read with profit by any teacher; parents and their children should be happy to have it in the library.

J. S. R.

ANDERSON, HAROLD H., BREWER, JOSEPH E., AND REED, MARY FRANCES. *Studies of Teachers' Classroom Personalities, III.* Stanford University Press, 1946. 156 p. \$2.00.

This is the third monograph of the series, *Studies of Teachers' Classroom Personalities*. In this series the relationship of the personality of the teacher to the behavior of the children is investigated statistically. The classifications of the personalities are distinguished as being integrative or dominative. These categories are determined on the basis of the behavior of children who are in the classes taught by the teachers. The validity of the procedure for classifying and recording the behavior patterns was made a matter of initial concern, and was statistically established. In this study two second-grade teachers were followed to learn if there was a continuance of integrative personality in the one, or dominative personality in the other. This continuance was established. The study further considered whether improvement might be made in a dominative situation over a five-month period. Two third-grade situations were studied. It was found that the learning climate deteriorated in a dominative situation, but improved in an integrative situation.

The study draws conclusions for the mental hygiene programs of the in-service education of teachers. The need for thoughtful attention on the part of the teacher to his interpersonal relations with others is stressed.

The evidence presented should be of interest and concern to teachers who are anxious to improve their work, and to administrators who are concerned with the performance of the teaching staff.

J. S. R.

WEAVER, WARREN (Editor). *The Scientists Speak*. New York: Boni and Gaer, 1947. 369 p. \$3.75.

This is a compilation of the series of science talks made by well known scientists over a nationwide radio hook-up on the New York Philharmonic-Symphony broadcast. The series has been sponsored by the U. S. Rubber Company. Many people, including science teachers, have listened to these interesting, non-technical talks. Science teachers will especially appreciate this compilation. The speakers have included many of America's most outstanding scientists. Chapter headings are as follows: the science of the earth, the science of the sky, the science of new materials and improved processes, new instrumental techniques, new chemicals, atoms and molecules, physics and mathematics, chemistry and living things, plants and animals, fundamental biology, the sci-

ence of ourselves, science and health, the natural and social sciences, science and the war, and the long-term values. Each chapter has an additional suggested reading list. Eighty radio talks are included.

G. B. K.

HAUSMAN, LEON AUGUSTUS. *Birds of Prey of Northeastern North America*. New Brunswick, N. J.: Rutgers University Press, 1948. 164 p. \$3.75.

There are approximately eighty species of eagles now known and they are distributed over the entire world.

The Bald Eagle was adopted as our national emblem by act of the Second Continental Congress of 1782. The spray of olive in the bird's right claw indicates the peaceful disposition of our Republic, while the bundle of arrows clutched in its left claw proclaims our ability to defend our pacific ideals.

The nest of the bald eagle is four to nine feet in diameter. Eagles remain mated for life and return to the same nest, adding to it from time to time.

The information I have just given is a sample of the interesting information which the book contains. We know that most birds of prey are some of man's most valuable allies in maintaining balance among the living creatures that compete for the possession of this earth. Mr. Hausman writes of three general classifications of birds of prey of Northeastern North America—American vultures, American hawks and their kin, and owls. The book contains thirty drawings of birds by Jacob Bates Abbott. In the back of the book is an index of vernacular names of birds of prey and a bibliography.

This is an excellent supplementary book for high school students in general science and biology. Biology, general science, and elementary science teachers will find the book an accurate, authentic account. Much of the material has been checked by Doctors Arthur A. Allen and Elsa G. Allen of Cornell University.

C. M. P.

BAILEY, JOHN WENDELL. *The Mammals of Virginia*. Richmond, Virginia (27 Willway Road): John Wendell Bailey, 1946. 416 p. \$5.00.

This is an account of every kind of wild and domestic mammal, including man, known to have lived in Virginia within historic times, plus a list of fossil forms found within the commonwealth. There are 99 illustrations, and the text is thoroughly documented and indexed. Altogether this is a most interesting book and should serve as an unusually fine reference book for elementary science, general science, and biology classes. While specifically useful in the schools of Virginia, schools in other eastern and middle western states would find in their states many of the mammals described. If you or one of your pupils wants to know something about a certain mammal, you will probably find it described in this book. Read-

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ers of Science Education may have the book at a special rate of \$4.00. The textual material is printed on an unusually high grade of paper, which serves to greatly improve the quality of the photographs.

C. M. P.

NEEDHAM, JOSEPH. *History Is on Our Side*. New York: The Macmillan Company, 1947. 226 p. \$2.75.

The author subtitles this little book "A Contribution to Political Religion and Scientific Faith" in an ingenious twist of words. In his own field we know Dr. Needham as a famous zoologist and an expert in embryology. He writes in line with the recent trend for scientists to explore the realm of the non-scientific—religion, politics and philosophy, or shall we say—humanism. Here are a dozen essays written between 1931 and 1942, selected to mediate the central theme. Challenging chapter headings such as "The Two Faces of Christianity," "The Nazi Attack on International Science" lead the reader to select readings that intrigue his curiosity.

Dr. Needham reveals a larger than usual grasp of knowledge—not that of the mere specialist or technician, but embracing as much as one man may, the whole pattern of life. His concern, in common with other contemporary great figures in science like Millikan and Compton is directed to bridging the gap between science and human values. We are long overdue on a program of put-

ting science in its proper relationship. A new phase of knowledge can develop and intoxication that compels man to forget the whole of life as though one of its elements if absorbing enough, could in itself satisfy all the requirements of living.

It is interesting to examine Needham's reference to collectivism and communism.

As a thorough-going evolutionist the author ties biology in with social and material "progress!" The fact that the forms of life have advanced lends hope that human history will by struggle, trial and error and the pressure of selection, tend towards general advancement of the race. It is in this way that "history is on our side."

F. A. R.

FECHNER, GUSTAV TH. (Transl. Lowrie.) *Religion of a Scientist*. New York: Pantheon Books, 1946. 279 p. \$3.50.

The German physicist and philosopher who writes this book represents but one of many in a more recent trend of scientists to save their species from charges of materialism and undue concern with "things" and mechanism. Through his works, and as plain citizen he earned the title of poet, satirist, controversialist and humorist and he expressed a multiple personality in the use of his pen names. He was a very intense individual and at one time the strains and frustrations tended to unbalance him and caused him to show depressive reactions.

Of all of the writings of Fechner in the varied fields of psychology, philosophy, physiology and religion, the translator-reviewer presents in particular, samples of Fechner's best and most mature synthesis of religion and science. This is done namely in respect to such selected ideas as faith, the soul, the soul of plants!, God and immortality.

Fechner as seen through the eyes of Lowrie and as translated by him, will be worth reading—there are unusual points of view, refreshing presentations and not a little profundity. The book could be read in a few hours and that reading will determine whether it will be worthwhile wading through the many writings in the original German.

F. A. R.

HOLMES, S. J. *Organic Form and Related Biological Problems*. Berkeley: University of California Press, 1948. 169 p. \$5.00.

The author considers whether or not the biologist can offer any real explanation for living organisms which constantly re-form their own bodies, regenerate cells or organs that are lost, and preserve the normal balance of their physiological functions.

There are chapters treating such related topics as the reversal of development, the regeneration of the blood and its bearing on the morphogenic theory, the role of gradients, cancer as a biological problem, the theory of recapitulation, and the bearing that recent work on autocatalytic enzymes and viruses has on the old problem of the origin of life.

Teachers of survey courses in biology, general biology, and heredity will find this treatise most interesting and challenging.

E. D.

CLEMENTS, EDITH S. *Flowers of Prairie and Woodland*. New York: The H. W. Wilson Company, 1947. 83 p. \$2.25.

The present book is the fourth in a series of similar books that have been planned with the idea of enabling the nature-lover to learn the names of familiar or beautiful wild flowers, as well as interesting facts about them, without recourse to technical keys or dry descriptions. Life-size portraits of the flowers have been made in color and are included in this book, adding much to its attractiveness.

The titles of the three previous books in the series are *Flowers of Mountain and Plain*, *Flowers of Coast and Sierra*, and *Flower Families and Ancestors*. Elementary science and biology teachers and all persons interested in knowing more about the flowers found in woodlands and prairie will be delighted to have this beautifully illustrated book. Both the common and scientific names are given for each flower, with the range and many interesting facts and descriptions.

E. D.

RIEDMAN, SARAH R. *How Man Discovered His Body*. New York: International Publishers, 1947. 128 p. \$2.25.

Man's curiosity to know more about his own body in order that he might be healthy and well and know how the body and mind functions lead to a series of discoveries which remain as unfinished business today. More discoveries are now needed and will come through research and study, just as they have in the past. One idea or discovery leads to another. There are things that may retard discovery in our day just as in the past when Galen's book and wrong ideas influenced thought and retarded progress for a thousand years.

Men who left their imprint on the paths of time in the science of the body were Hippocrates, Galen, Vesalius, Harvey, Priestly, Lavoisier, Bernard, Cannon, Parlor and Banting. Hippocrates was a Greek, Galen a Roman, Vesalius a Belgian, Harvey an Englishman, Bernard a Frenchman, and Banting was a Canadian.

Each discovery came when the time was ripe, when enough work had been done to prepare for it. During the rebirth of learning, man again began to ask questions and brought forth Vesalius, the anatomist; Copernicus, the astronomer; and Galileo and Newton, the physicists. Harvey built his work on that of the Italian anatomists; Malpighi on the work of the microscope makers, Borelli and Hales learned from Newton; Voit and Pettenkoffer from Lavoisier. In the last century, the improved microscope led to the study of the cell, and a wonderful painkiller made possible many discoveries about living animals.

Often politicians, commercial interests, or old established firms gain control of a new scientific discovery and it is not used to the best interests of all the people. Atomic energy may be used to the betterment of man or to his detriment. It all depends on those who are entrusted with the new scientific discovery.

The book is a *Young World Book* and is about high school age level; illustrated and contains an excellent chronological table of material and cultural advancement from 400 B.C. to 1945.

F. M. D.

SLAUGHTER, FRANK G., M.D. *Medicine for Moderns*. New York: Julian Messner, Inc., 1947. 246 p. \$3.50.

We strive to be healthy in order to be happy, but how many of us strive to be happy in order to be healthy.

Modern medicine is concerned not only with the body but with the mind and the emotions to a far greater degree than in the practice of medicine in the past.

Many of our diseases have an emotional, subconscious foundation. For example, those emotions which cause one to shrink away from life activities and to want to again seek mother's protection may result in skin diseases, asthma, diabetes, or high blood pressure. The other

extreme are those who have "a great success drive" and want to "out-do father" or anyone and everyone and the result is coronary thrombosis. Patients who show angina pectoris symptoms have usually set a lower goal for their drives, and their conflicts are less superficial, less of a threat to the ego.

The author states that we must now attack the scourges born of our emotional discords as courageously and as enthusiastically as we have germs in the past. This authoritative book explains psychosomatic medicine and tells what it can do. Frank G. Slaughter, M.D., is also the author of *The New Science of Surgery*.

The last chapter in the book is *For Parents Only* and it should be a "must" reading assignment for any young man or woman contemplating marriage. The pioneer woman, the great grandmothers of generations today was on the whole a successful mother and housewife. The author shows the great part medicine today can do toward the betterment of the family but he adds that doctors cannot do everything; there is a great job to be done building strong, stable personalities in our children, preventing damaging conflicts. This is a job for parents only.

Another chapter in this very excellent book which shows our fight against the quack is far from over, is "Is This Operation Necessary?" Other chapter headings will give the reader some indication of the interesting reading in store for him: "My Love is Rosy Red," "Some Call it Migraine," "Asthma, Allergy and Emotion," and "Coronary Thrombosis: The Price of Success."

Dr. Slaughter takes up the most obviously psychosomatic illnesses one by one—dyspepsia, ulcer, spastic colitis, and "chronic appendicitis." Heart troubles and high blood pressure are often psychosomatic illnesses, each with its special personality type. Diabetes and asthma also have their physical causes. Migraine, skin troubles, goiter, and backache are all within the ever-widening province of psychosomatic medicine.

F. M. D.

GOLDSTEIN, PHILIP. *Genetics Is Easy*. Hoboken, New Jersey (77 River Street): Garland Publications, 1947. 72 p. \$0.75.

Biology teachers and students, and elementary science teachers will find this an excellent pamphlet for obtaining a better understanding of genetics. Many questions raised by teachers and pupils are here answered simply and accurately. Fundamental facts and theories upon which ideas in heredity are presented.

E. D.

SYMPORIUM. *Colloid Science*. Brooklyn: Chemical Publishing Company, 1947. 208 p. \$6.00.

This text is made up from a series of lectures given on Colloidal Science at Cambridge University in England under the auspices of the Royal Institute of Chemistry. The lectures summarize much of the research in colloid systems, both biological and non-biological, as a "background

for attack on the more complex case of the disperse systems as well as interpreting the phenomena encountered with matter in the form of films, membranes, and fibers."

With some of the best equipment that exists, these experienced workers have greatly advanced this study the two types of interface, the solid/gas and the liquid/gas. Among the topics discussed are: Surface Chemistry and Colloids; Foams and Emulsions; Electrokinetic Phenomena; Colloidal Electropotentials; The Viscosity of Macromolecules in Solution; the Kinetic Theory of High Elasticity; Emulsions in Vivo; Membrane Equilibrium; Infra-red Spectra and Colloids; and Vinyl Polymerization in Liquid Phase. There are many helpful diagrams.

W. G. W.

LAMPERT, L. M. *Milk and Dairy Products*. Brooklyn: Chemical Publishing Company, Inc., 1947. 291 p. \$7.00.

This book brings to the reader summarized information of recent research relating to milk and its products, in nontechnical language. It covers nutritive value, composition, chemistry, bacteriology and processing of milk and dairy products. Composition, food value, contamination, pasteurizing, homogenizing and sterilizing are treated. There is good discussion of diseases that may be caused by infected milk. One whole chapter is devoted to the vitamins in milk. Butter and oleomargarine are compared. Evaporated and condensed milk, dry and malted milk, and methods of production are described. We also learn about the many varieties of cheese and ice cream. The book is very well illustrated with 71 cuts, mostly halftones. Forty-one tables give much condensed information. A bibliography of 12 pagers offers ample references for further study of the subject.

W. G. W.

HUTCHINSON, J. B., SILOW, R. A., AND STEPHENS, S. G. *The Evolution of Gossypium and the Differentiation of the Cultivated Cottons*. New York: Oxford University Press, 1947. 160 p. \$4.25.

This monograph embodies the results of twenty years research into the origin of the cotton plant and its development as a commercial crop. In it the authors have presented a comprehensive account of the evolution of gossypium based on the history of cotton.

The earliest civilization to spin and weave cotton was that of the Indus valley, and for many centuries the cotton plant was known outside India only in travelers' tales. The fragments of cotton fabrics found at Mohenjo-Daro have been dated at approximately 3000 B.C. The textiles of Babylonia and Egypt were still of linen and wool when Herodotus wrote in 445 B.C. Cotton seems to have developed as a crop in China between the seventh and thirteenth century of the present era. Cotton in the New World seems to have originated according to botanical evidence in the

mountain valleys of northwestern South America about 2000 years ago.

Primitive cotton seems to have been perennial plants with highly colored lints. Cultivated cotton plants do not grow well in too much moisture or in too much competition with other plants. Cultivated plants very soon die out when left alone.

F. M. D.

HARRY, RALPH G. *Modern Cosmeticology*. Brooklyn: The Chemical Publishing Company, 1947. 515 p. \$12.00.

Every practical and scientific aspect of cosmetic preparations receives attention in this completely revised edition. Included are many published and unpublished investigations carried out in this field. Particular attention is paid to the effects of cosmetics on the skin and health. Formulas for preparing various cosmetics are included such as face powders, face and hand creams and lotions, sunburn and suntan preparations, vanishing creams, deodorants, depilatories, dental preparations, hair dyes, bath preparations, hair shampoos, eye lotions, foot preparations, and so on. This is a useful book for the chemistry teacher and the manufacturer. Chemistry clubs and students will find here many suggestive activities.

E. D.

DETHIER, VINCENT G. *Chemical Insect Attractants and Repellents*. Philadelphia: The Blakiston Company, 1947. 289 p.

This is said to be the first complete and reliable account of the way in which various chemicals attract and repel insects. Economic entomologists will find the book particularly interesting and useful. Stimuli include thermostimuli, photostimuli, and mechanostimuli.

Natural odors and scents to which an insect is normally subjected assist it in recognizing and locating its mate, its fellow, oviposition sites, and food. Such odors are attractants. Odors by which an insect is repelled usually serve to protect it. The scent of practically all plants may be said to be due to essential oils. There are chapters on baits and traps, repellents, and evolution of feeding preferences.

F. M. D.

AVERY, MADALYN. *Household Physics*. New York: The Macmillan Company, 1946. 470 p. \$4.50.

Some subject matter has been added, some omitted, and some rearranged and reorganized in this revised edition of *Household Physics*. The usual divisions of physics subject matter are retained, and the mathematics has been kept as simple as possible. Practical rather than theoretical phases have been emphasized.

C. M. P.

AVERY, MADALYN. *Household Physics Laboratory Manual*. New York: The Macmillan Company, 1946. 92 p.

This manual contains 25 experiments to accompany the author's text, *Household Physics*. For

the most part they are quantitative and are capable of yielding good results. The use of modern equipment which will be encountered in everyday life has been emphasized.

C. M. P.

BALDWIN, ERNEST. *Dynamic Aspects of Biochemistry*. New York: The Macmillan Company, 1947. 457 p. \$4.00.

This is primarily an advanced textbook in biochemistry. Part I considers the enzymes and Part II metabolism. The author is a university lecturer in biochemistry at Cambridge University.

E. D.

PRICE, WILLIAM E. *Laboratory Chemistry*. Yonkers, New York: World Book Company, 1947. 133 p. \$0.92.

This chemistry workbook consists of 48 usual experiments in high school chemistry plus 14 project experiments. The manual is of the fill-in-blank type with an emphasis upon practical experiments. The workbook may be used with any text.

E. D.

CLIPPINGER, DONALD R. *Manual of Quantitative Analysis*. Boston: Ginn and Company, 1947. 339 p. \$3.50.

This manual presents, in workbook form, the fundamentals of quantitative analysis. Part I treats general procedures and techniques; Part II volumetric techniques; Part III gravimetric techniques; Part IV physicochemical techniques; and Part V appendix.

E. D.

KIVER, MILTON S. *F-M Simplified*. New York: D. Van Nostrand Company, Inc., 1947. 347 p. \$6.00.

Frequency modulation is explained fully, completely, and simply as possible. This book covers the construction and operation of the transmitters and receivers and all applications are emphasized.

E. D.

COVER, S. L. *Workbook in Mechanical Drawing*. New York: McGraw Hill Book Company, Inc., 1947. 201 p. \$1.48.

This introductory course in mechanical drawing is designed for junior and senior high schools. Today one needs to be able to read and interpret drawings, house plans, statistical information and graphs that he finds constantly in daily papers, magazines and books. The units covered in this manual are: projection box, sketching, home planning, blueprint reading and practical drawing problem dimensioning, special shop projects, fasteners, charts and graphs. The manual is well illustrated, has pages of symbols, lettering practice, simple construction projects and touches many topics of special interest to young students. The training one gets from this course will be of great value in many practical situations that enter one's daily life.

W. G. W.

OLSON, HARRY F. *Elements of Acoustical Engineering*. New York: D. Van Nostrand Company, Inc., 1947. 539 p. \$7.50.

The first edition of this book was the subject matter of thirty lectures prepared for presentation at Columbia University. Fundamental principles used in modern acoustics and descriptions of existing acoustical instruments and systems are included. The work is quite technical and is designed for advanced students in physics.

C. M. P.

PISANI, TORQUATO J. *Essentials of Strength of Materials*. New York: D. Van Nostrand Company, Inc., 1947. 229 p. \$2.80.

This book is designed to present in a brief and systematic manner a text in elementary mechanics and strength of materials suitable for students in technical high schools and technical institutes and in the better vocational high schools.

C. M. P.

RANSON, STEPHEN WALTER, AND CLARK, SAM LILLARD. *The Anatomy of the Nervous System: Its Development and Function*. Philadelphia: W. B. Saunders Company, 1947. 532 p. \$7.75.

This is the eighth edition of a book first published in 1920. The order of presentation has been somewhat altered, various parts have been rewritten, and new material and illustrations have been added. There are 417 illustrations.

C. M. P.

GARDNER, ERNEST. *Fundamentals of Neurology*. Philadelphia: W. B. Saunders Company, 1947. 336 p. \$4.75.

The material presented in this volume is based upon dissection and microscopic study of the nervous system, analysis by experimental methods and the study of neurological disorders. There are 133 illustrations.

E. D.

RICE, THURMAN B. *A Textbook of Bacteriology*. Philadelphia: W. B. Saunders Company, 1947. 603 p. \$7.75.

This is the fourth edition of a book considered by many to be the outstanding book in its field. The book is sufficiently elementary to serve as an excellent reference to the biology, general science, and elementary science teacher. High school libraries should have it as a reference source on bacteria.

C. M. P.

ETHERIDGE, MAUDE LEE. *Health Facts for College Students*. Philadelphia: W. B. Saunders Company, 1947. 439 p. \$3.00.

The text contains twenty-nine chapters. At the end of each chapter there are thought provoking questions for the benefit of students and teachers. Although the textbook is intended for the use of college students, I see no reason why it cannot be used in high school classes in physiology and health. The reading is simple and not beyond the average high school student's ability of comprehension.

Diagrams, tables, and graphs help to clarify the textual material. It is most unfortunate that many young people today will not have the opportunity to learn the scientific facts and receive the advice given by the author which is based, no doubt, on long experience in working with people and in the medical profession.

F. M. D.

KING, BARRY GRIFFITH, AND ROSER, HELEN MARIA. *Anatomy and Physiology Laboratory Manual and Study Guide*. Philadelphia: W. B. Saunders Company, 1948. 267 p. \$3.00.

This is the third edition of a fill-in blank type of laboratory manual, with the major revision being in the section on endocrines.

E. D.

STROMSTEN, FRANK A. *Davison's Mammalian Physiology*. Philadelphia: The Blakiston Company, 1947. 349 p. \$4.25.

This is the seventh edition, including 187 illustrations of which 92 are new. Special reference is made to the cat.

C. M. P.

CURTIS, WINTERTON C., AND GUTHRIE, MARY J. *General Zoology*. New York: John Wiley and Sons, Inc., 1947. 794 p. \$4.50.

This is the fourth edition of a textbook first published in 1927. Material has been revised, reorganized, and brought up to date. The textual material seems to be quite readable and it is supplemented by 524 illustrations. It would serve as an excellent reference for biology and general science teachers.

E. D.

GARARD, IRA D. *Introduction to Organic Chemistry*. New York: John Wiley and Sons, Inc., 1948. 396 p. \$3.50.

This is the third edition of a widely used organic chemistry textbook. The greatest revision involves the new material on hydrocarbons, made necessary by rapid advances in the petroleum and synthetic rubber industries. The chemistry of carbohydrates and proteins receives greater emphasis.

E. D.

RILEY, HERBERT PARKES. *Introduction to Genetics and Cytogenetics*. New York: John Wiley and Sons, Inc., 1948. 596 p. \$5.00.

A cytological approach to the study of genetics is emphasized in this book. The basic principles of biological inheritance are stated and explained. The importance of these principles to man, to the improvement of plants and animals, and to organic evolution is emphasized. Both plant and animal material is included. Chromosomes and their close association with the transmission of the gene receive continuous stress.

E. D.

SCHEER, BRADLEY T. *Comparative Physiology*. New York: John Wiley and Sons, Inc., 1948. 563 p. \$6.00.

Comparative Physiology is suitable as a textbook in an advanced course for students having a background of physics, chemistry, and zoology. The book examines the variations in function and interprets them in the terms of structural variation, evolutionary history, and ecology.

E. D.

WORTHING, A. G., AND HALLIDAY, DAVID. *Heat*. New York: John Wiley and Sons, Inc., 1948. 522 p. \$6.00.

This is a complete presentation of the current theory and practice in the field of heat. The discussion largely concerns "classical heat"—with the main emphasis on experimental methods.

E. D.

HEADQUARTERS STAFF OF THE AMERICAN RADIO LEAGUE. *The Radio Amateur's Handbook*. West Hartford, Connecticut: The American Radio League, Inc., 1948. 616 p. \$2.00.

This is the twenty-fifth edition of a publication that has become as much of an institution as amateur radio itself. Most of the material has been completely rewritten. The *Handbook* emphasizes practical utility, and its treatment of radio communication problems is in terms of how-to-do-it. Altogether this revision is the most comprehensive in recent years.

E. D.

MARCUS, ABRAHAM, AND MARCUS, WILLIAM. *Elements of Radio*. New York: Prentice-Hall, Inc., 1948. 751 p. \$4.00.

This is the second edition of a book first printed in 1943. It is intended to provide the beginner with a simplified, practical, home study course in radio. The authors state that no previous training or scientific knowledge is necessary to master the fundamentals presented. The author uses a spiral form of organization, starting with the simple and concrete, before taking up complex principles.

The material is authoritative, the authors having taught radio courses for more than thirty years. Questions and problems accompany each chapter and there are 500 diagrams and illustrations to explain the text.

This would be an excellent book for the high school student interested in radio and physics, and for the general science and physics teacher.

E. D.

WOOD, LAURA N. *Louis Pasteur*. New York: Julian Messner, Inc., 1948. 218 p. \$2.75.

Louis Pasteur was born December 27, 1822, and died September 28, 1895.

Louis Pasteur lived his early boyhood in the little town of Arbois in the Jura Mountains, far

to the southeast of Paris. His father was a tanner. Upon the suggestion of his teacher, the young lad of fifteen was sent to Paris to attend school. He was homesick almost from the first day, and after one month his father came and took him home. Later he attended school at Besancon not far from his home. At the age of nineteen he was studying in Paris and later received his Ph.D. there. He wrote a thesis in Chemistry and in Physics. Then he went to southern France to Touron to teach and experiment. He made experiments with tartaric acid and paratartaric acid and made discoveries of great importance. He had been able to go beyond the work of the great master Biot.

He taught one year in high school at Dijon and then went to the Alsatian capital Strasbourg. His research took him on into Germany. He was thrilled with the beauty of the Rhine area around Cologne and impressed with the transportation facilities of Germany. Second class accommodations of travel there were better than first class in France. The laboratories and equipment of the German scientists were magnificent in comparison to what he had been accustomed. From Germany he went on into Austria and Czechoslovakia.

Louis Pasteur thought at times that he would never hear the end of the spontaneous generation theory. He had to battle his critics almost continuously. His family urged him to seek the truth and not be disturbed by those who opposed him. Pasteur could not forgive Colin for his chronic carping. "He contradicts out of perversity. It is a neurosis with him, and no demonstration on earth could cure it."

Finally a little boy bitten by a mad dog six days before, was brought to him. Louis, his years of study and research now to back him up was ready and it was decided to inoculate him and prevent rabies from developing and killing the boy. The boy lived and many more came to be inoculated when bitten by dogs or wolves with rabies. Louis Pasteur received great honors but the love, admiration, and appreciation of the common people whose lives he saved, improved and made better was of most significance. The Pasteur Institute was founded in his honor.

The book contains a series of photographs of Pasteur, members of his family, fellow scientists and places of interest to the great scientist. Always he felt he owed everything he had been able to achieve to the love and devotion of his family and to his country, France. It is advisable to refer to a map of France and locate places mentioned in the sojourn of Pasteur. The reader is then more able to appreciate the environment and locale in which the great scientist lived and worked, devoting his whole life to the good of humanity. This is an unusually fine book for all secondary science students and teachers. Survey course students at the college level would read this book with enjoyment and appreciation.

F. M. D.

